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Studies, Then What?

Till about ten years ago, a large proportion of those engaged in electronics at technician level were self-taught, with knowledge expanded from the armed forces, the factory assembly line or an initial hobby interest. This random situation is now changing as more and more technicians enter the industry with some organised training, ranging from private college tuition to advanced technical certificate courses.

Unfortunately, however, there seems to have developed a tendency for some to regard such courses as an end in themselves. Having completed a course and acquired a certificate, the student writes "finish" to his studies. He takes up a position involving him in set tasks, to do with quality control, communications, maintenance or some other defined activity. He learns to use the relevant equipment, some of it quite elaborate, and comes to equate the environment and his proficiency at the set task with technical sophistication. He fails to appreciate that, for lack of use, his store of other knowledge is wasting away.

Adding to the problem is the increasing use of module techniques. These can only accelerate the emergence of 9-to-5 technicians, who are proficient at carrying out set tasks but who have little occasion to think about other aspects of electronics.

Training courses are fine as a means of laying down a foundation of organised knowledge but this knowledge needs continually to be supplemented and up-dated. If the means to do this are not inherent in one's position, I know of no better substitute than good, old-fashioned do-it-yourself hobby activity. The technician who becomes involved in amateur radio is painlessly kept in touch with receivers, transmitters, aerials, feedlines and the relevant techniques. The technician who builds and uses an audio system maintains an interest in pickups, records, tapes, loudspeakers and amplifiers.

The choice of a hobby interest and the use of one's spare time should be just as much the subject of mature decision as one's choice of a career.

In laying an emphasis on do-it-yourself activity, "ELECTRONICS Australia" is not catering for a race of aimless fiddlers. It is encouraging readers to enquire, to experiment, to build and thus to vitalise and broaden their formal studies.

Williams

ovember, 1966

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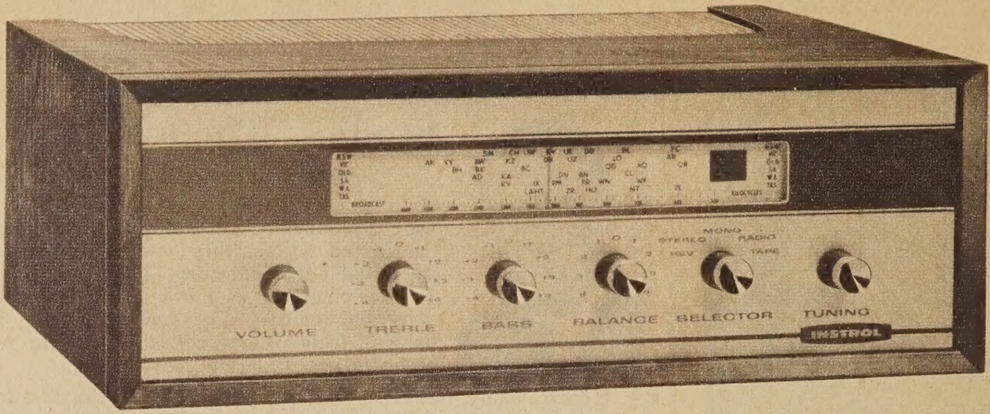
COVER PICTURE: A battery of coloured lights and a tray of 1X2 EHT rectifier assemblies at the Rydalmere Factory of the Amalgamated Wireless Valve Co. Pty. Ltd. provided the design for this month's cover. Though the filament itself is relatively fine, its support assembly must be very rigid. 1X2 rectifiers use a special lead-glass bulb.

New INSTROL Amplifier-tuner



A Custom built precision instrument tastefully presented in a high quality, craftsman made cabinet. Designed in Australia to suit Australian conditions, and made from readily available local materials. This new Stereo Amplifier/Tuner, has all the features of its imported counterparts, yet is much superior in appearance and performance.

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- ★ Continuously variable bass and treble controls.
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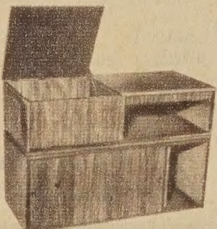
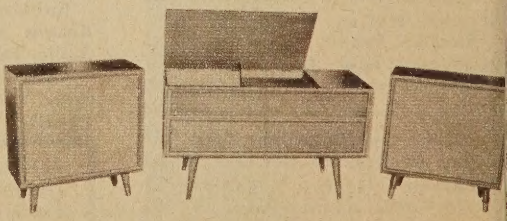
PRICE

Without Cabinet	**$133.50 (£66/15/-)**
Extra for Cabinet:	
Walnut or Maple	**$15.00 (£7/10/)**
Teak or matched special ..	**$16.50 (£8/5/)**

INSTROL ...fine audio furniture



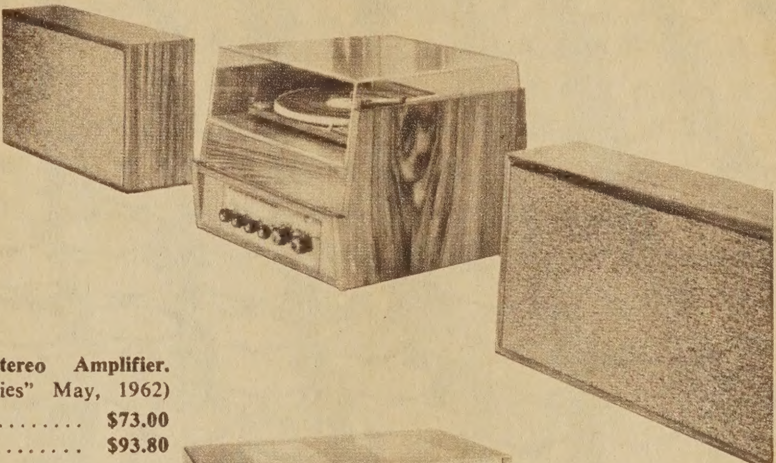
A complete range of high quality Hi-Fi Cabinets. Tailored to suit the equipment of your choice, and most economical. In the Instrol range there are over 20 equipment and speaker cabinet designs. Each is available, built and polished or **in Kit form to make yourself.** A hammer screwdriver, and a few hours of your time is all you require to make your own. All parts pre-cut, best quality materials, full instructions supplied—all for little more than half the cost of ready made cabinets. It's great fun too—but why not send or call for the free Instrol Cabinet Brochure. Profusely illustrated with full specifications and measurements.



Produced precisely to the original designs by "Electronics Australia" (previously "Radio Television & Hobbies") the Instrol-Playmaster range includes units to suit every audio requirement. Tuners, Amplifiers, Pre-Amps, Speaker Systems, etc., all available either as completely built and tested units, or in Kit form to build yourself. Our HI-FI Catalogue is available free upon request.

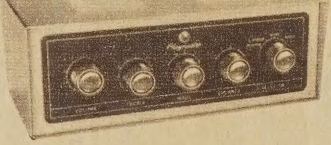
INSTROL—*PLAYMASTER*

Top right. The Instrol-Playmaster transistorised Stereo Amplifier No. 113 ("Electronics Australia," December, 1965 and March, 1966). Fitted in specially designed cabinet which also accommodates a record player. A pair of Instrol-Playmaster Bookshelf Speaker systems, (or Mini-Speakers), make up a compact, reasonably priced outfit.



Instrol-Playmaster No. 4 Stereo Amplifier. ("Radio Television and Hobbies" May, 1962)

Kit of Parts	$73.00
Built and Tested	$93.80



Instrol-Playmaster No. 111 Tuner ("Electronics Australia" October, 1965)

Kit of Parts (with Magic Eye)	$39.00
Built and Tested	$53.00

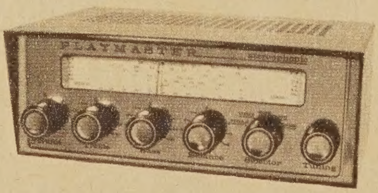
No. 114 TUNER B/CAST with R.F. ("Electronics Australia," Sept. 1966)

Kit of Parts (with Magic Eye).	$47.00
Built & Tested (Magic Eye) .	$71.80

PLAYMASTER PROGRAM SOURCE

Instrol-Playmaster No. 106 Stereo Amp/Tuner. ("Radio, Television & Hobbies," December, 1963).

Kit of Parts	$96.50
Built & Tested	$117.30



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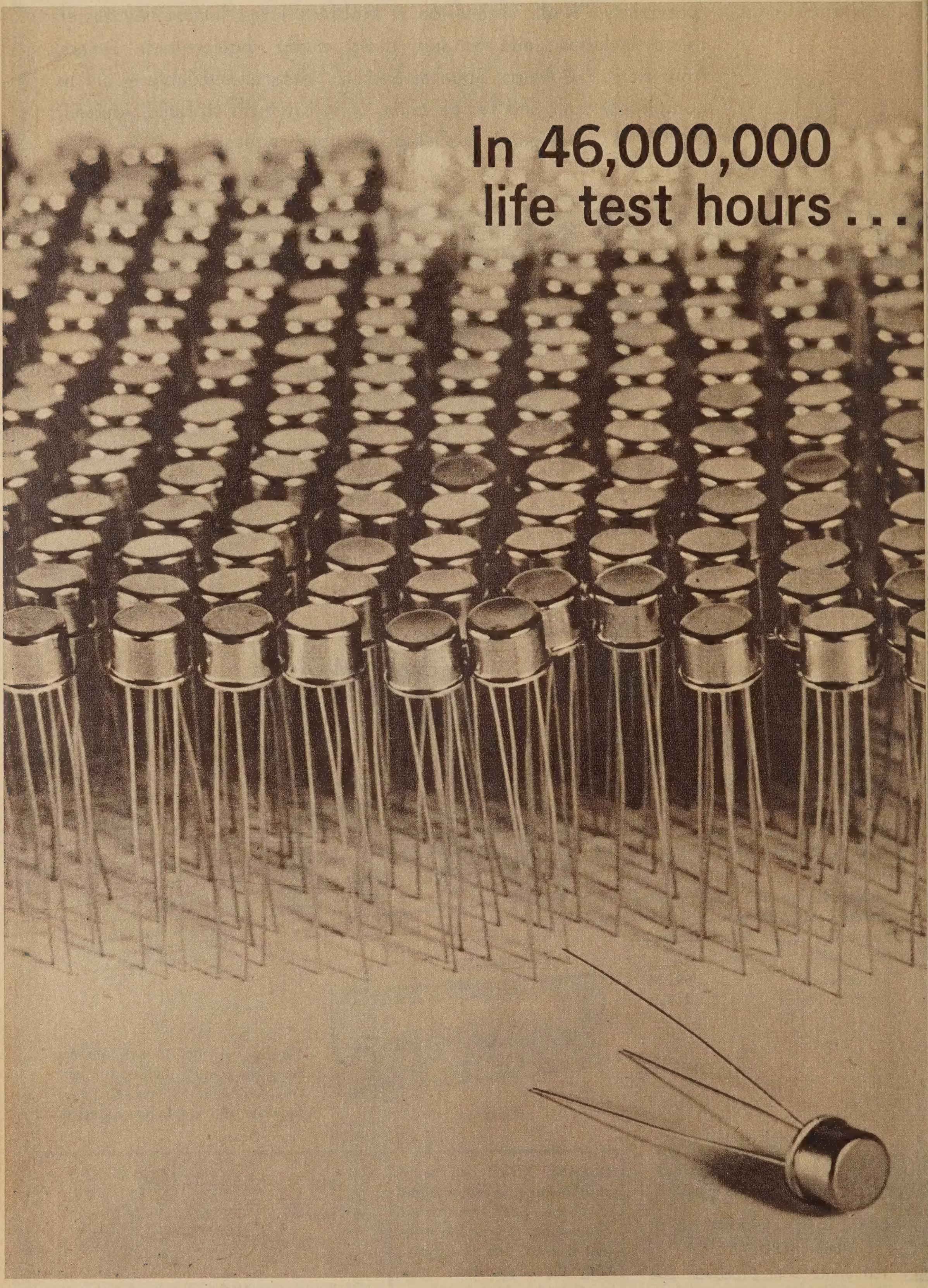
In 46,000,000
life test hours . . .

We were really hoping for a lot more. We were trying to develop acceleration factors to make life testing more efficient — a study we conducted as part of the Fairchild Minuteman Programme. With only one mechanical failure in those 46,000,000 operational life hours, the test was relatively unsuccessful as we obtained a failure rate of 0.004%/1,000 hours with 60% confidence and no acceleration factor!

... there had to be one dropout

But such life testing studies are only a part of the six phase Fairchild Quality Assurance programme that provides Fairchild's customers with devices of a reliability never obtained by any other manufacturer.

The Fairchild Quality Assurance Programme starts with Phase I, the examination and testing of all incoming materials. We not only examine the components but the tools and equipment as well — and these are also subjected to regular re-examination.

Phase II includes all tests carried out during production. Each individual transistor or microcircuit is accelerated at a rate of 30,000 G's, dropped ten times, cycled three times from +200°C to —65°C, and checked for leaks as fine as 10^{-6} cc/second. A complete log is kept of the progress of each batch, and each operator's production is checked four times a day providing immediate feedback to correct any possible process deviations.

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Phase III is a series of fifteen environmental tests designed to simulate operating conditions normally encountered—only tougher.

Phase IV is straight murder for microcircuits. The tests in this phase are set at extremes with the object of achieving a high percentage of breakdowns to determine failure modes and design weakness. Samples are subjected to 200,000 G's acceleration and thermal shock of going straight from boiling water to liquid nitrogen (variation 295°C). They are even run at 60 times their rated power. The centrifuge tests have produced a maximum of 4.2% failures and the thermal shock tests have produced none!

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The parameters of every individual transistor or microcircuit are observed before being branded, catalogued and put into stock.

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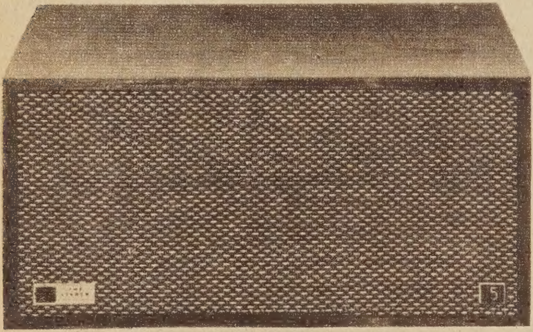

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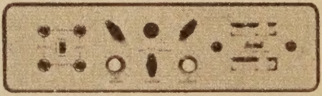

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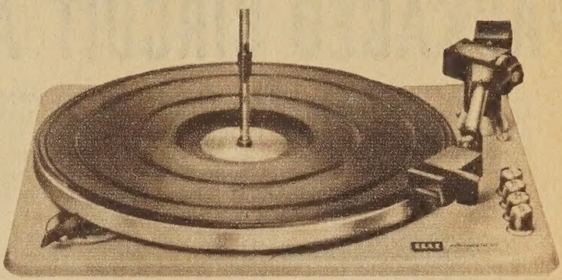

actory cartridge installation ensures optimum playback uality and lowest record wear. Distortion and tracking roblems eliminated.

liracord 40 plays records manually or automatically, ngly or in sequence, at all speeds. Features include: eavy, 1-piece, dynamically balanced 12" turntable; dynamially balanced tone arm; calibrated stylus-force dial; highorque, 4-pole induction motor.

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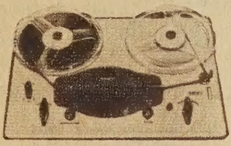

)ECK. Mark 5 eries 3-tape eck. Two witches control ecord, play-ack, wind and ewind — pause nechanism, lus special witch for supermposing. Deck itted with ¼ or ½ track stereo erase and reord/playback heads. Invaluble for recording speech with nusic or adding musical backround. From $118.

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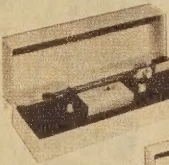
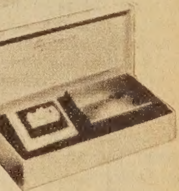


TK-15-LS/TK-15-P



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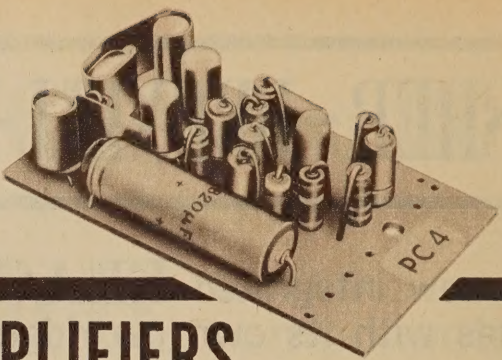

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Each unit is guaranteed for 12 months and replacement units are supplied if any fault develops. Our guarantee also enables the manufacturer to guarantee his product to the ultimate user.

some applications

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Supply voltage	220-250 V	200-250 V
Max. load current	150 Ma	500 Ma
Max. no load output voltage for 240 V input	11 V (± 5%)	15.6 V (± 5%)
Min. full load output voltage	8.5 V at 150 Ma	11.3 V at 500 Ma
Max. ripple voltage	200 Mv RMS for 150 Ma	600 Mv RMS for 500 Ma

specification details

A typical miniature Audio-Amplifier is illustrated actual size overleaf. Circuits are of transformerless, complementary symmetry type, operating off Standard Voltages. Can be wire-in or plug-in as required.

PERFORMANCE DATA	PC1	PC2	PC3	PC4	PC5	PC7	PC9
Power Output mW	150	400	400	400	3W	800	Pre-amp
Input Sensitivity mV	50	1	5	150	5	5	1V
Input Impedance ohms	1.5K	1K	2.5K	220K	1.5K	1.5K	1M
Output Impedance ohms	40	15	15	15	3	8	600
Supply Voltage-volts	9	9	9	9	12	9	9
Typical distortion %	2	3	3	3	3	3	1
Frequency response	300-15K	200-12K	200-12K	200-12K	50-12K	50-12K	20-20K
Overall Dimensions All ¾ in. high	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾	2 x 1

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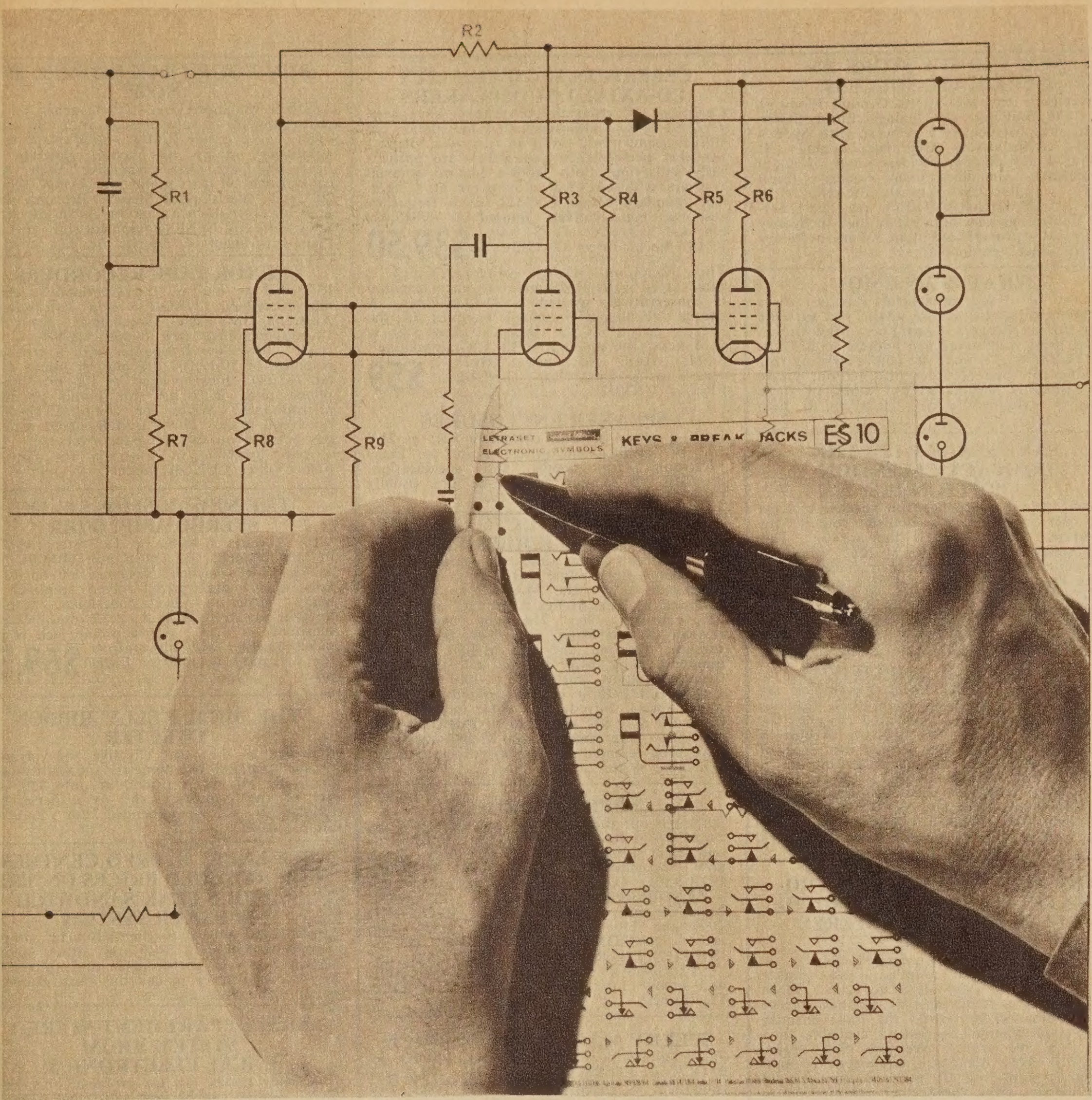

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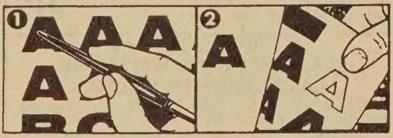

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ACOUSTECH AMPLIFIERS

As Australian Agents Encel Electronics are proud to be associated with these famous American amplifiers, considered to be the finest in the world. The first two Acoustech shipments were sold out within two days of arrival in Australia! Of particular interest is the Acoustech Model V, an integrated solid state stereo amplifier with an output of 45 watts RMS per channel — a rating applicable throughout the extended frequency range. This model is priced at **$350**

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Price with the COSMOS SW-30C stereo amplifier is only **$175!**

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The Acoustic Lens provides maximum dispersion of high frequencies when used with the Kelly Ribbon Tweeter. Made of high density plastic, the lens simply fits to the front of the tweeter . . . up to 15 kc/s the coverage pattern is constant within 3 db over 150 degrees. Price **$10**

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Celestion 12" co-axial loudspeakers have been received most enthusiastically by audio enthusiasts and music lovers in Australia. Clarity, transient performance and attack are particularly satisfying. Both models feature co-axial tweeters with electrical cross-overs at 4 kc/s. The Standard Model CX1512 has a frequency response **conservatively quoted** at 30-15,000 c/s and is rated at 15 watts RMS. Encel Price CX1512 ...... **$39.50**

The "Celestion" Deluxe Model CX2012 is rated at 20 watts RMS and frequency response is **conservatively quoted** as 30-18,000 c/s. A special "Brilliance" control operates in the tweeter circuit — the electrical cross-over is at 4 kc/s. See reviews in the "Gramophone" p.511, April, '65, and "Hi-Fi News" p.75, June, '65. ENCEL PRICE: CX2012 .... **$59**

SPEAKER ENCLOSURES

Both speakers perform extremely well in 2½-3 cu. ft. speaker enclosures; write to Encel Electronics for details and specification. Speakers of similar UK price are usually twice Encel prices in Australia.

SPECIAL INTRODUCTORY OFFER ON MICRO EQUIPMENT!

The "Micro" tone arms and cartridges are absolutely outstanding in their respective categories . . . the MA77 tone arm was reviewed in "Electronics Australia" pages 126-127, February, 1966. The same pages carried reviews of two Micro cartridges, the SC 301 ceramic diamond and the M-1007 magnetic diamond. The MA77 arm and the stereo diamond stylus cartridge M-1007 sell for **£stg26 (£A32/10/-)** in the United Kingdom. Encel Special Introductory Offer includes both items for only **$47 (£A23/10/-)! IMPORTANT:** 100 MA77 tone arms and 100 M-1007 cartridges have been reserved to meet the expected heavy demand. Write or call now!

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Although our range of tape recorders is wide, Encel prices have assured speedy turnover . . . and Encel sales are at an all time high. Stock now includes: TRUVOX R44, R102-104, PD102-104; REVOX G36, two and four track —TANDBERG 64, and Series 12; AKAI M8, X4, 355, 1710, X100D — BEO-CORD 2000 and 1500 — SONY 500a 357/4, 200, etc. — NATIONAL 703S, 705, 755S, etc. — PHLLIPS EL 3553, EL 3556, EL 3558, etc. — FERGUSON — GRUNDIG — LUXOR and many more. Save much more at Encel Electronics!

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Please give us your name and address in BLOCK LETTERS when ordering. All Encel equipment is BRAND NEW and Sales Tax is included in Encel prices. We care-pack and freight anywhere. Service is available at the Encel Service Centre in Melbourne and also at the Encel Stereo Centre, 257 Clarence Street, Sydney.

A NEW HIGH QUALITY TONE ARM AT A LOW, LOW PRICE!

The new Encel-Nikka tone arm is a precision instrument and will track perfectly down to ½ gram with suitable cartridges. The open front head shell accepts all standard ½" fitting cartridges — and the arm takes Ortofon and SME shells without modification. Miniature ball bearings are used throughout. An outrigger bias adjustment sets stylus pressure. Encel price is only **$19 (£9/10/-).** Make your own comparisons with any other arms anywhere near the Encel price **$19**

IMPROVE TREBLE PERFORMANCE WITH THE CELESTION TWEETER!

The Celestion HF 1300 tweeter is patterned on the well known GEC BSC 1852 and may be added to any existing speaker through a capacitor which Encel Electronics supply free of charge. Frequency response of the HF 1300 is level within plus or minus 2 db from 1500 c/s to 13 kc/s and extends well over 15 kc/s. Improvement in treble performance is immediate. Encel price **$15**

BUY YOUR LEAK "STEREO 30" NOW!

Trade-in valuations are at their peak . . . so write now for a valuation on your old equipment . . . or an EMQ! Solid state stereo amplifiers occupy less space, generate less heat and are less expensive than valve equivalents. If you prefer the LEAK "Stereo 20" and "Varislope 2 Stereo" Pre-amp you'll find Encel trade-in valuations most attractive; up-grading to LEAK equipment can cost less than you imagined. Write or call now!

LUXOR TAPE RECORDERS

Regarded as one of the Continent's leading tape recorders, LUXOR is now distributed in Australia by Encel Electronics Pty. Ltd. Illustrated is the new model MP464, a four track - three speed recorder with a frequency response of 50-19,000 c/s plus or minus 4 db. (at 7½ ips). Pick-up sens. is 100 mV, microphone sens. is 7 mV for mono or stereo microphones. Write for complete specifications and price. This LUXOR stereo recorder has been favourably reviewed overseas — and is now available in Australia for the first time. Other LUXOR models will follow.

THE NEW COSMOS SW-30C STEREO AMPLIFIER

With 8 watts R.M.S. or 15 watts I.H.F.M. in each channel . . . push pull 6BM8's . . . and a wide frequency response of up to 20 kc/s, this budget priced stereo amplifier has many attractive and functional features. Speaker matching is 4, 8 or 15 ohms. Pick-up sensitivity is 5 mV, a headphone jack is provided together with all controls for necessary flexibility. Encel price **$69.50**

THE MK.II KELLY RIBBON TWEETER

Regarded as the most effective and advanced tweeter available for domestic speaker systems, the Kelly Mk. II is priced at only **$39.** The use of the Acoustic Lens to disperse high frequencies is recommended for improved performance.

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SILK DEPARTMENT STEREO SYSTEM FROM ENCEL ELECTRONICS!

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AKAI AA-5000 solid state stereo amplifier (or ADC-60 solid state stereo amplifier). ORPHEUS SILEX turntable with MICRO MA-77 tone arm and ORTOFON stereo cartridge fitted with elliptical diamond stylus, two Leak "Sandwich" speaker systems. ENCEL PRICE **£295.** **$590**

Supplied with a LEAK "Stereo 30" solid state stereo amplifier and two KEF "Celeste" speaker systems . . . in place of the Akai/ADC-60 and "Sandwich" systems, price tumbles to **£240.** **$480**

Hear this splendid system at Encel Stereo Centres in Melbourne or Sydney. P.S. Encel prices include Sales Tax

ASK FOR AKAI PRICES!

ALL AKAI models are in stock . . . M8, X4, 355, X1000D and 1700. Encel trade-in prices and end-user EMQ's are more than just attractive, too!

THE REVOX G36 PROFESSIONAL 2 OR 4 TRACK STEREO AND MONO TAPE RECORDER

Encel Electronics recommend this famous Swiss recorder. Three motors are featured in this versatile two-speed professional quality recorder which takes 10½" spools; ask for an EMQ or a trade-in valuation on your old unit.

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Encel price .... inc. Sales Tax **$33**

HAMMOND CONDENSER MICROPHONES

As Australian Distributors, Encel Electronics proudly announce the arrival of the first Hammond shipments. The new Hammond Stereo Microphone is supplied complete with a power supply and is priced at **$118.** The monaural Model 101 with power supply costs only **$74** . . . the extra capsule may be added at a later date to convert to stereo use. Hammond microphones combine rugged construction with high performance and have been favourably reviewed overseas. Write for full specifications.

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A wide range of "Sonics" speaker systems is now on display at Encel Stereo Centres . . . and individual prices are as low as **$19.** For the budget conscious music lover or for the tape enthusiast who wishes to up-grade speaker quality, "Sonics" offer unusually good value. Cabinets are hand finished in oiled teak or walnut veneers. Model AS302 features a 12" bass reproducer and a horn type tweeter with variable brilliance control . . . **$47 (£23/10/-).** Model AS-60 two speaker system . . . **$25 (£12/10/-).** Model AS-41 3 speaker system — 2 woofers and a tweeter . . . **$31 (£15/10/-).** Several others in stock. Come to your nearest Encel Stereo Centre and hear the "Sonics" range!

THE ALL NEW LUX SQ 101 SOLID STATE STEREO AMPLIFIER WITH SILICON TRANSISTORS AND 80 WATTS PEAK POWER OUTPUT!

Priced at only **$179** the mighty new LUX SQ101 amplifier has an input sensitivity as low as 1.8 mV, input for mag. p.u. being 3.5 mV. Distortion is negligible at normal domestic listening levels . . . and a unique tone control offers variable bass and treble crossover frequencies. Every useful tone and input facility have been provided. Send for full details. **(£89/10/-).** **$179**

SPECIAL ANNOUNCEMENT

Encel Electronics Pty. Ltd. has been appointed Australian National Distributors for two of the United Kingdom's best known manufacturers . . .

CONNOISSEUR
TRUVOX

A complete range of Connoisseur turntables and pickups is now in stock . . . also TRUVOX tape recorders, tape decks and solid state stereo amplifiers. For further details, see the full page advertisement in this issue of "Electronics Australia". Encel Electronics' **prices** will make these high quality products available to **thousands more** Australian music lovers!

THE NEW ENCEL CSM-40 M.F.B. STEREO AMPLIFIER!

The remarkable new Encel CSM-40 offers more features, more performance, more value . . . similar units are usually twice the Encel price. Output is over 15 watts RMS (over 35 watts I.H.F.M.) in each channel, frequency response is 20-40,000 c/s, input sensitivities are as low as 1.5 mV. Loudness control, rumble filter, scratch filter, separate bass and treble controls, tape monitor, headset jack, motional feedback control and circuitry, substantial grain-oriented output transformers . . . all are standard on the Encel CSM-40. The balance meter may be switched in and out of circuit . . . the filaments of the pre-amplifier are DC . . . the output of cartridges such as the ADC 10E and 4E will load the CSM-40 and provide excellent results. Above all, this stereo amplifier is most satisfying to sit and listen to . . . see and hear the CSM-40 at Encel Stereo Centres in Melbourne and Sydney. Mail orders will be care-packed and freighted anywhere. Encel price is only **£64/10/-** **$129**

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Many Encel prices cannot be advertised because of trade agreements . . . so we invite you to write for an EMQ . . . an Encel Mail Quote. When requesting prices on amplifiers and tape recorders, please give some specifications. Combinations of many components are possible . . . just tell us of your requirements. Please supply your full name and address printed in BLOCK LETTERS.

FIRST RELEASE OF CELESTION "POWER RANGE" LOUDSPEAKERS!

Two mighty new speakers are now available from Encel Electronics. These rugged and powerful units are particularly suitable for public address, guitar and organ applications; in Europe both are extremely popular.

MODEL G15C. Capable of handling a power input of 35 watts RMS, this 15" Celestion speaker has a frequency response ideally suited for P.A., organ and guitar. Total flux is 180,000 maxwells. Feroba II ceramic magnet. Encel price **$65**

MODEL G18C. A massive loudspeaker with an output of up to 60 watts RMS. Fundamental resonance: 35 cps. Total flux: 285,000 maxwells. Voice coil diameter is 3" —overall diameter is 18". Write for complete specifications. Encel price **$95**

LOW PRICED SOLID STATE STEREO AMPLIFIER BY "SOUND"!

Just released! Model SAQ-202B . . 6 watts RMS per channel, separate bass and treble controls, input sensitivity is 100 mV for pick-up, tuner and auxiliary. In attractive metal case. Freqency response is 30-20,000 c/s, plus or minus 3 db. 12 transistors. Encel price **$49** (£24/10/0)

"SARLON" SPEAKER FABRIC

Many types of SARLON acoustic fabrics are now available at Encel Stereo Centres . . . ask to see them! Several types are of particular interest to the ultra modern home owner.

KEF "CELESTE" SPEAKERS

The new model "Celeste" with the improved Super Tweeter is now on display.

THE NEW PLANET MG-1504 STEREO AMPLIFIER

This extremely well finished stereo amplifier is also a fine performer . . . with a total power output of 15 watts (I.H.F.M.) and a frequency response of 30-20,000 c/s plus or minus 2db. Speaker matching for 4, 8 or 16 ohms. Valve complement 2 x 12AX7, 1 x 6AQ8, 1 x 6CA4, 2 x 6BQ5. Encel price is only **$59**

A NEW SOLID STATE STEREO AMPLIFIER . . . THE "SOUND SAQ-501"

This well designed fully transistorised stereo amplifier has an output of 32.5 watts (IHFM) in each channel into an 8 ohm load, a frequency response of 20-20,000 c/s plus or minus 1 db., magnetic pick-up sensitivity of 3 mV and all controls desirable for complete flexibility of operation. Loudness control, rumble filter, scratch filter, tape monitor and on-off control are all tumble-type switches. Write for full specifications. **$115**

* IMPORTANT NEWS FOR PURCHASERS OF STEREO TUNER/AMPLIFIER SYSTEMS

Encel Electronics has been appointed Australian Distributors for the famous Danish manufacturer, Hede Nielsens Fabriker A./S., home of the renowned "Arena" integrated amplifiers. The Model T1900F has just arrived . . . a completely transistorised stereo amplifier/tuner combination in traditional Danish styling. See the recent review in the "Gramophone," page 43, June, 1966. This unit is suitable for ceramic or crystal pick-ups, has FM/SW (2 bands) MW/-LW tuners, an output of 8 watts RMS per channel and is ideal for cabinet or bookshelf installation. Price in the U.K. is £stg61/19/0 . . . Encel price is only $138! See the "Arena" at your nearest Encel Stereo Centre! **$138**

EXCLUSIVE ENCEL OFFERS FOR NOVEMBER

1 The new "Sound" 202B solid state stereo amplifier (6 watts RMS per channel), Labcraft 643 turntable with stereo diamond cartridge, two Wharfedale 8" speakers **$115**

2 The ideal budget system. Planet MG1504 stereo amplifier (8 watts I.H.F.M. per channel), Connoisseur turntable, Connoisseur tone arm w/lift and stereo diamond cartridge, two 8" RS/DD Wharfedale speakers . . . **$138.** With a Labcraft 643 turntable and a B & O stereo diamond cartridge in place of the Connoisseur group price is only **$128**

3 Roland FAX-150 stereophonic amplifier with AM/FM tuners, Connoisseur turntable, Connoisseur SAU-1 tone arm with lift, Connoisseur stereo diamond cartridge, two Wharfedale 10" RS/DD speakers. **$199**

4 Sansui Model 220 stereophonic amplifier with AM/FM/SW tuners, Connoisseur Craftsman transcription turntable, Ortofon SMG 212 tone arm and Ortofon SPU-GT-E elliptical stylus cartridge, two Celestion CX 1512 12" co-axial wide range loudspeakers **$350**

5 Leak "Stereo 30" Akai 5000 or ADC 60 solid state stereo amplifier, Orpheus Silex turntable, Micro MA77 tone arm, ADC 10E elliptical stylus cartridge, two Celestion CX 2012 co-axial speakers. (The arm was reviewed in "Electronics", April, '66 !). Encel price only **$450**

6 The new Encel CSM-40 stereo amplifier, Labcraft 605 or JH turntable, JH MkII or Encel-Nikka tone arm, ADC 770 or Micro 2000/5 stereo diamond magnetic cartridge, two twin cone Wharfedale 10" RS/DD speakers **$219**
(With the new COSMOS SW-30c stereo amplifier **$159**

Make up your own combinations . . . of any components you wish . . . and write for an EMQ. Encel prices are the LOWEST in Australia . . . and the service at Encel Stereo Centres is the best!

EARLY ENCEL SPECIALS AVAILABLE!

The special offers made from time to time by Encel Electronics in "Electronics Australia" are often kept open for several months. In many cases, the prices quoted are still applicable. Please check with us!

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FILM ANIMATION BY COMPUTER

by Dr. E. E. Zajac

Bell Telephone Laboratories, Murray Hill, New Jersey, U.S.A.

By feeding a cathode ray tube with data from a computer it becomes very easy to make animated motion pictures illustrating a mathematically complex sequence of events. The technique has great potential, in enabling research workers to visualize the results of computation and in preparing educational films.

Suppose you are teaching a course in celestial mechanics. You want to show the satellite orbits that would result if Newton's universal law of gravitation were other than in inverse square law. On a piece of paper you write:

```
DELT = 1.0
TFIN = 1000
EXP= −3
CALL ORBIT (DELT, TFIN, EXP).
```

Then you take the paper to the computation centre. After a few hours, you return to pick up a movie, which you then show to the class.

In the movie the positions of the satellite and parent bodies are drawn on a frame of film every minute of their orbits (DELT = 1.0) for the first 1000 minutes (TFIN = 1000). The satellite and parent body, obeying an inverse cube gravitational law (EXP= −3), start out in circular orbits. However, as you have shown in class mathematically, circular orbits for an inverse third power gravitational law are unstable. The 1000-frame (42-second) movie drives home the point; the students see the initial, almost perfectly circular orbits disintegrate, with the satellite making ever-closer swings about the parent body until the two bodies collide (figure 1).

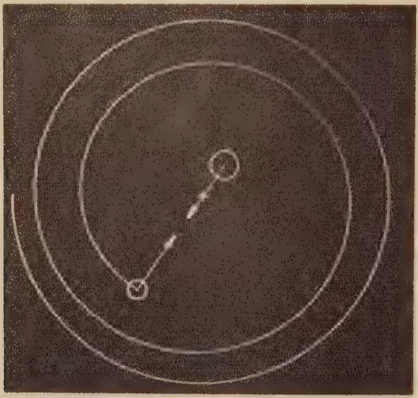

*Figure 1: Two massive bodies interact according to an inverse cube law of force. The bodies either spiral in and collide, as shown, or spiral outward. **

To those who have tried to make an animated scientific film by conventional means, this account may sound Utopian. Hand animation for a movie of this sort first requires the computation of the co-ordinates of the satellite for each frame of film. Then comes the tedious task of drawing and properly positioning the satellite 1,000 times on celluloid "cels." Finally, the cels have to be individually photographed.

Yet, at the Bell Telephone Laboratories, I can today write the program I have shown and obtain 16mm film ready for viewing, within three or four hours. At present there is only a handful of installations in the world where this procedure is possible. But within a few years, I suspec it will be available at most major universities and industria laboratories in the United States and Western Europe.

The cost of making the film, including computer time and processing, but not including my labour, would be about $30. However, this cost and the above description are deceiving, for they do not take into account the worl of my colleague, F. W. Sinden, who constructed the "subprogram" called ORBIT which computes the orbit and produces the film. To have a more balanced view, we have to consider how computer pictures are drawn and how subprograms such as ORBIT work.

The computer-driven cathode ray tube—Figures 2 and 3 are themselves computer drawn, to illustrate the picture-making process. The instructions or program for the picture are fed into the computer, usually on punched cards (figure 2). The computer then calculates numbers that specify the picture and the commands for film advances These are read on to magnetic tape, shown in the bottom right of figure 2. Next, the tape is rewound; it is then connected to a cathode ray tube and the film-advance mechanism of a camera (upper right, figure 3).

As the tape is run from its beginning, the numbers on the tape are translated into electron beam commands for the cathode ray tube; the picture appears on the face of the tube and is recorded on the camera film (the shutter is always open). When a frame is completed, a command from the tape to the camera causes the film to advance to the next frame. All this happens at electronic speeds, so that a film such as the celestial mechanics film described earlier might be made at the rate of five to 10 frames per second or about one quarter of the rate of standard movie projection.

Programming of computer animation—The cathode ray tube performs only two basic tasks: (1) it "types" a small font of standard-sized letters and (2) it sweeps a straight line segment between two specified points. (The description here pertains specifically to the SC-4020, a computer-driven cathode ray tube manufactured by the General Dynamics Corporation. However, other computer-driven cathode ray tubes work in a similar manner.)

Although these tasks are performed with high precision and reliability, they are in principle extremely simple The advantages of computer animation do not lie with an an elaborately versatile cathode ray tube. Rather, they lie with the power of a high-speed digital computer: Indeed, the special virtue of computer animation is that it brings the power of computing to the film medium.

To illustrate this power, let us consider how one builds a program for an animated film, starting with the line-drawing ability of the cathode ray tube. An example of the basic line drawing command is:

```
CALL LINE (−5, 3, 15, 22)
```

This command causes the electron beam to connect the point with horizontal co-ordinate X= −5 and vertical co-ordinate Y=3 to the point with co-ordinates X=15, Y=22 The plotting area of the cathode ray tube is a square with

---

Originally published in "New Scientist," Vol. 29, No. 482.

and Y ranging between —512 +512, giving more than e million reference points.

The above instruction is written in a standard scientific ogramming language called Fortran, although Fortran ers will note that, in the interest of clarity, I have taken rtain liberties with standard Fortran.

A Fortran program is actually executed in two passes rough the computer. On the first pass, the symbolic Fortn instructions are translated into the basic numerical code the computer; the output is a set of punched cards or a agnetic tape. In the second pass, this numerical code is ad from the cards or tape and executed; the result is the al numerical output of the computer .

Fortran was written to allow symbol manipulation, akin ordinary algebra (Fortran is derived from "FORmula ANslator"). For example, the two commands

```
Y=5
CALLINE (—15,Y,30,Y)
```

ll cause a horizontal line to be drawn from the point X= 15, Y=5 to X=30, Y=5. Symbolic specification is connient in the writing of "loops", for example

```
DO THRU*, I=1,100
Y=I
*CALL LINE (—15,Y,30,Y)
```

first instruction signals the formation of the loop. It mmands the computer to execute 100 times the instrucns following, up to and including the instruction marked the asterisk. Each time through the loop, the Y co-ordin- of the line is given the value of the counter, I. So on 29th pass through the loop Y=29, on the 30th pass =30, and so on. In this example, 100 horizontal lines, iced vertically one unit apart and lying between Y=1 d Y=100 would be drawn on a single frame of film.

Computer loops are tailor-made for animation. To istrate, first introduce the instruction CALL FRAME. rtran translates this into a command to the camera to vance the film by one frame. Insertion of CALL FRAME o the loop gives:

```
DO THRU* I=1,100
CALL LINE (—15, Y, 30, Y)
Y=I
*CALL FRAME
```

e result is animation. We get 100 frames of a movie owing the steady upward motion of a single horizontal .

Even this simple four-instruction program illustrates eral points. First of all, note that a computer loop is the same as a film loop. A film loop repeats the same uence of **events** over and over.

A computer loop repeats the same sequence of **nmands** over and over. A command, such as Y=I, may l for a change from the previous passage through the p. Thus, the event produced in each passage through the p generally **differs in a systematic way** from the event duced in the previous passage.

Secondly, note the case with which we can change the gram to produce a new animated sequence. Suppose we at the action to go only one-half as fast. We simply lace the command Y=I by Y=I/2, and the command THRU* I—1,100 by DO THRU* I=1,200. Or we ht decide that the line should extend from X= —5 to =50. This requires only that we change the LINE call to LL LINE (—5, Y, 50, Y).

In fact, we could allow for all of these changes at e by using symbols. The addition of an instruction, AD, allows us to specify particular values at the time running. The complete program then looks like this:

```
READ, SPEED, X1, X2.
DO THRU* I=1,100 × SPEED
Y=I/SPEED
CALL LINE (X1, Y, X2, Y)
*CALL FRAME
STOP
3, 10, 72
```

The READ instruction says to the computer, "When card containing STOP has been reached all instructions his program will have been loaded in. Look for numbers the next card. Set SPEED equal to the first number, X1 he second number, and X2 to the third number. Then cute the program."

For each particular set of values of SPEED, X1, X2, get a different film. This illustrates another point of great ortance; a successful program generates more than a le film; it makes possible a whole **family** of films. The ily is a function of several variables just as in hematics a family of curves can be a function of several

HOW COMPUTER MOVIES ARE MADE:

In this new method of animation, both film motion and display on the tube can be controlled automatically by information on a magnetic tape.

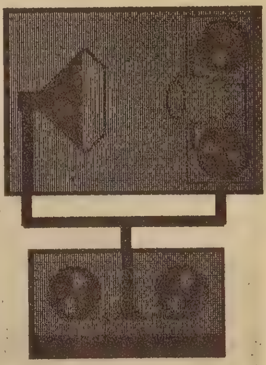

Figure 2: A program on punched cards for a picture is fed into the computer. The computer writes the numbers representing the computed picture on to magnetic tape. †

Instructions for the desired movie enter the computer as a deck of punched cards.

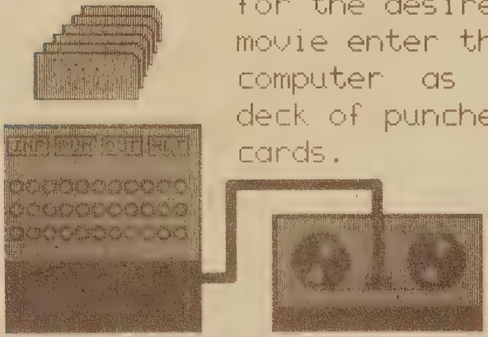

Figure 3: The computed picture is read from magnetic tape to drive a cathode ray tube and camera film advance mechanism. †

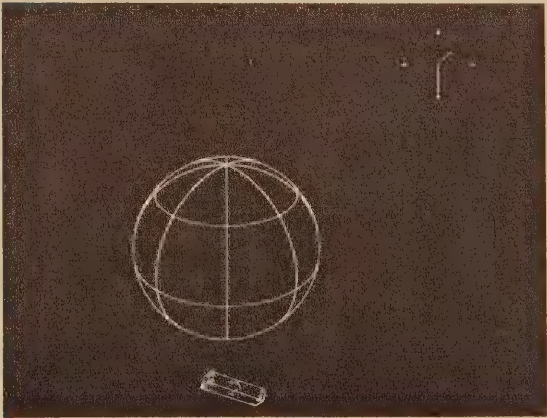

Figure 4: Box, representing a satellite, changes attitude according to a mathematical model of the Earth's gravity. Clock counts off orbits. ‡

* *From the film "Force, Mass and Motion."*

† *From the film "A Computer Technique for the Production of Animated Movies."*

‡ *From the film "Simulation of a Two-Gyro, Gradient Attitude Control System."*

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variables. For each particular choice values, a new film results. Differ choices may give films that do not ev resemble each other. Thus, in celestial mechanics example, a sin program using the Newtonian law gravitational force yields movies of cular, elliptical, parabolic and hyp bolic orbits, depending on the init conditions.

Modern computing allows still other freedom. We can make our p gram into a subprogram. First, we cide on a name. In Fortran, we limited to names of six symbols. pick HRZLIN (standing for horizon line). Then we modify the previous p gram as follows:

```
  SUBROUTINE   HRZLIN   (SPEE
     X1, X2)
  DO THRU* I=1,100×SPEED
  Y=I/SPEED
  CALL LINE (X1, Y, X2, Y)
  *CALL FRAME
```

This program is stored in the co puter or on cards once and for all. in some film in the future, we decide want to show an ascending horizon line, we would write:

```
  READ, SPEED, X1, X2
  CALL HRZLIN (SPEED, X1, X2)
  STOP
  2, 5, 50
```

If we did not want to experiment w several different SPEEDs, X1s and X but rather knew that these variab should have the values 2, 5, and the program would be shorter still:

```
  CALL HRZLIN (2, 5, 50)
```

This illustrates the powerful "nami or subroutine capability of programmi By this means we can build up a libr of programs as we go along. This rary differs markedly from the usual f library. Each entry represents a fam of films rather than a single film. E entry probably embodies loops. these are computer loops, not film loo

The reader can now, perhaps, und stand the celestial mechanics exam given at the outset. Having F. W. S den's general program, ORBIT, for p ducing a family of orbit films as a fu tion of the relevant variables, it simply a matter of writing the instr tion CALL ORBIT and specifying val to obtain the particular orbit fi desired.

Applications of computer animation Computer results usually emerge in form of numbers printed on paper, son times hundreds of thousands of numb per sheet on hundreds of thousands sheets of paper. With the computer a mation one can translate the numb into a series of pictures which can scanned in succession as a movie. Fig 4 is a frame from such a movie.

In this case, I was studying, by digi computer simulation, the orientation c trol of a satellite. At first, I had computer print out numbers giving satellite orientation at successive insta of time. The problem of visualising satellite motions from the printed nu bers was formidable. So I wrote a s program which took the numbers t would normally be printed out and u them to compute a perspective draw of a box representing a satellite.

Figure 5 shows the superposition every fifth frame of the movie for first satellite orbit (in the movie its the Earth turns). An orbital clock in upper right-hand corner counts off orb

In the program it is easy to char the point of view of the perspective.

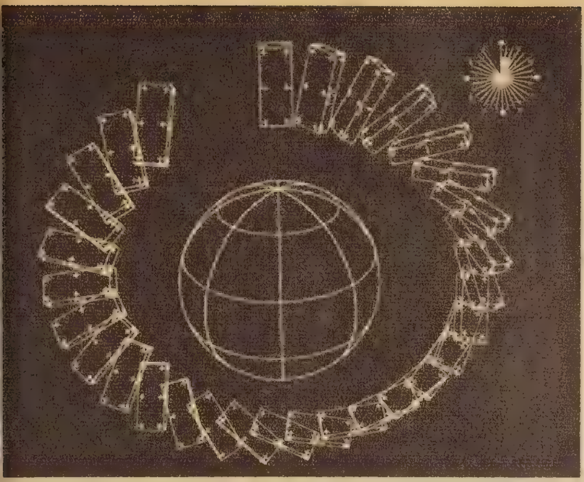

Figure 5: Superposition of every fifth frame during one orbit ‡

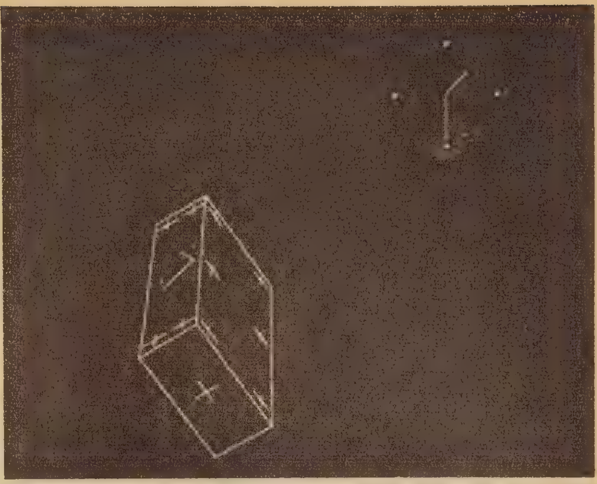

Figure 6: Satellite as seen in an orbiting reference frame. ‡

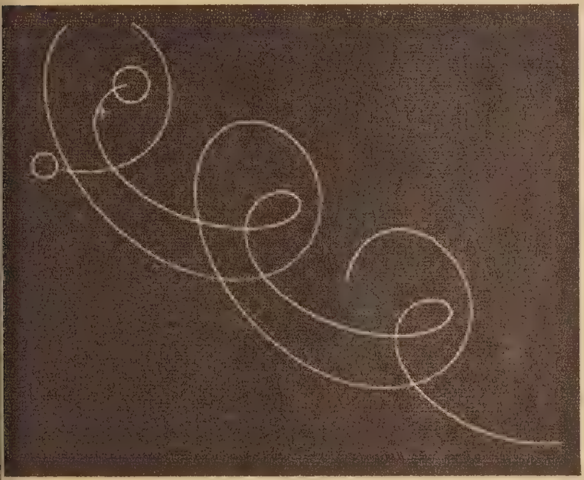

Figure 7: Orbits of bodies with inverse square law interaction. Plus sign is moving centre of mass. *

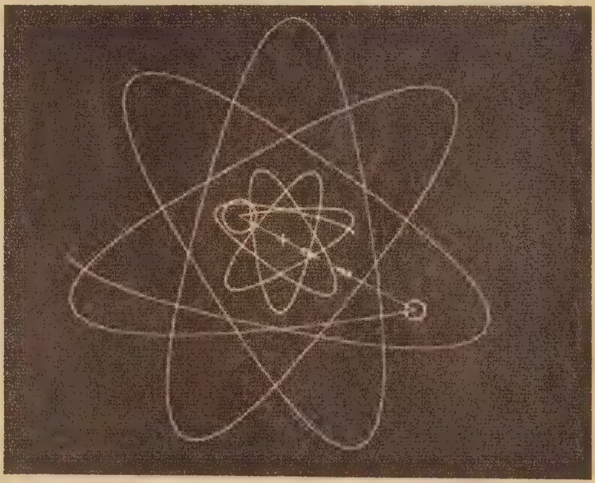

Figure 8: Orbits of two bodies with a direct cube force law of interaction. *

gure 6, also taken from the movie, e viewer is travelling in orbit with the tellite.

Most of the applications of computer imation so far have been of this sort usually short sequences visually displaying the results of a scientific comitation. Examples are:

A movie of successive iterates of an ration procedure for solving an optiisation problem (Bell Telephone boratories; Sandia Corporation).

Flow of a viscous fluid, including e formation of a von Karman vortex eet (Los Alamos).

Propagation of shock waves in a lid (Los Alamos; Lawrence Radiation boratory, Livermore, California).

Lines of constant pressure, tempera-re, precipitation, etc., in a dynamic teorological model of the Earth's eather (Lawrence Radiation Labora-ory).

Vibration of an aircraft (Boeing Air-aft).

Simulation of an aircraft-carrier land- (Boeing Aircraft).

Most of the animation has been in ack and white; however, the movies produced at the Lawrence Radiation Laboratory have been in colour.

The possibilities of the use of computer animation in this way as an output means for standard computing are limitless. Indeed, one can argue that graphical output is "natural," and the usual numerical computer output is woefully inefficient.

The human eye has great pattern recognition ability; for this very reason the usual first step in handling scientific data is to plot it. The human eye also quickly picks out a moving object from a static background. Movies allow one to take advantage of this ability by adding the dimension of time to the familiar spatial dimensions in studying computer output.

Moreover, many of the calculations done on a computer are of essentially dynamic phenomena. One wants to see the unfolding or evolution of a process either as a function of time or of some other variable. Motion pictures are the obvious way of accomplishing this.

Finally, as the sample frames of Figures 4-6 show, it is easy to make perspective views of solid objects. It is likewise easy to make two perspectives side by side, that is, to make stereographic movies. This line of research has been pursued by A. M. Noll of the Bell Telephone Laboratories. Among other things, he has made a movie of a four-dimensional cube rotating about one of its axes, as seen when projected into three dimensions.

Educational use of computer animation—The use of computer animation for the display of the results of scientific computations is a form of education—one scientist passing information to another. It suggests the use of computer animation for the classroom.

One immediately thinks of a whole host of phenomena and concepts that uniquely lend themselves to illustration by computer movies. The idea of a "limit" in the calculus, for example, is essentially a dynamic one, as the standard terminology suggests — "f(X) **approaches** f(Xa) as (X—Xa) **approaches** zero."

Other examples are Newton's laws of motion, kinetic theory in physics and chemistry, fluid flow in engineering—in fact, one can argue that a good deal of the instruction in the physical sciences is in terms of "movies" of mathematical

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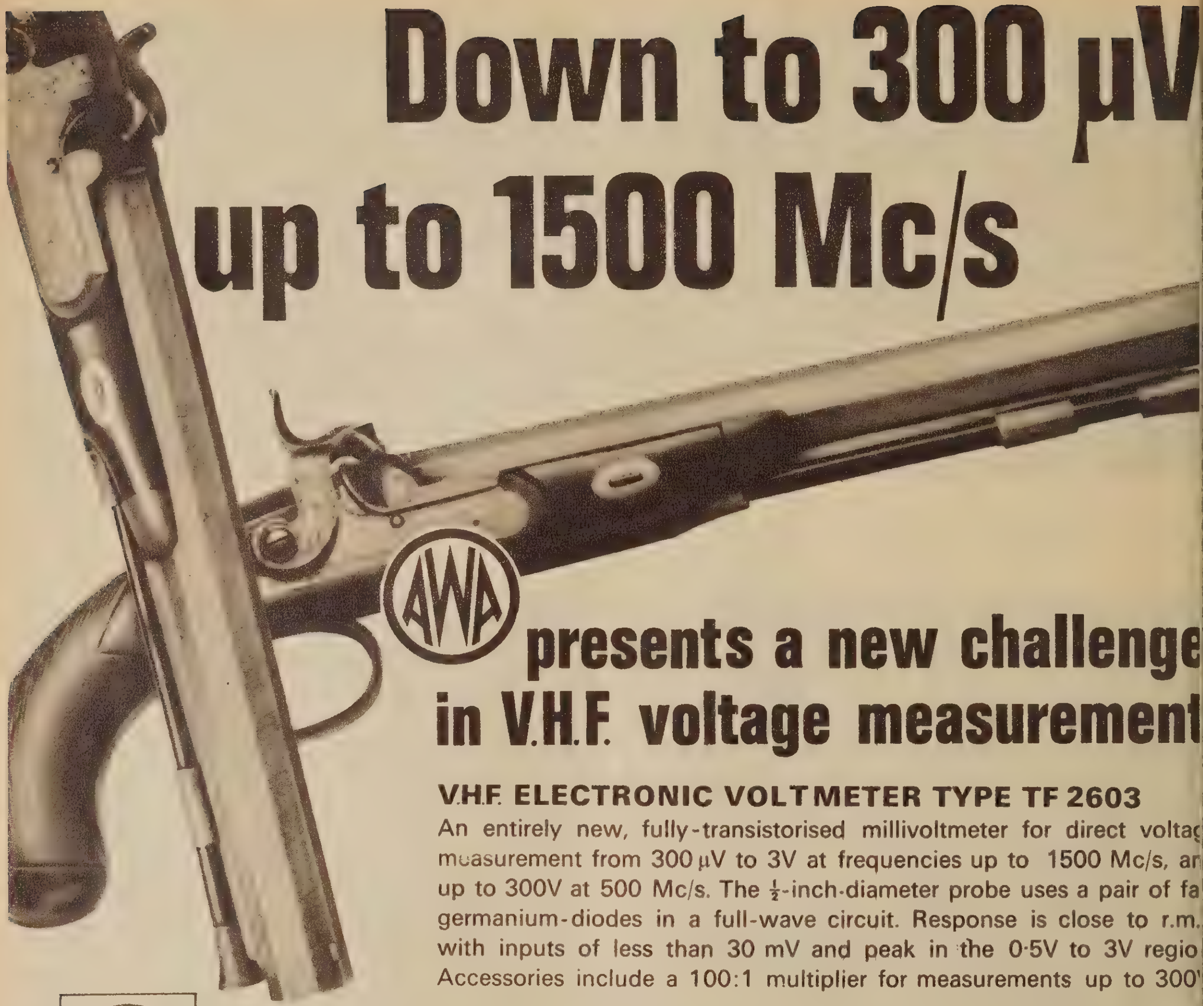

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MARCONI INSTRUMENTS

dels of nature — except that the dent does not normally see the vies; he only hears verbal descriptions them.

'erhaps more important is the oppor- ity computer animation gives to the ntist and engineer to make his own vies. As our examples have shown, user programs computer animation the language of mathematics, a guage in which the physical scientist engineer is proficient.

Moreover, the scientist can make s with a minimum of dependence on ectors, producers and animators. ch as in writing a book, where one mits a manuscript and receives back proof in print ready for reading, so one now submit a program and re- ve back a proof of film, ready for wing. The scientist can be master of own house; if he wishes, he can intain complete creative control over films he makes.

One might expect the professional nce film-maker to feel threatened by development. Paradoxically, the osite has been the case with the few -makers who have had a chance to computer animation and to appreci- its flexibility and power.

One professional animator told me t he has always been envious of nposers. All a composer needed was piano to try out his latest creation. animator on the other hand could y with great labour try out his ideas. example, if the action were too fast, would have to be redrawn and the ne laboriously rephotographed.

n computer animation, such things speed can be left as a variable. The -maker has much more freedom to eriment. He is free to bring his full stic abilities to bear in his partner- with scientists in film making.

One of the few purely educational nputer animated films is **"Force, Mass l Motion,"** by F. W. Sinden, of the Telephone Laboratories. The film strates Newton's laws in two dimen- ns. Orbits are shown of two massive ies under central force action for ious laws, such as inverse cube, direct e, etc., as well as for the familiar erse square law. Figure 1 and figures nd 8 are frames from Sinden's movie.

Another educational movie by Roger Shepard and the author is entitled **Pair of Paradoxes."** It combines two chological phenomena discovered ently. One, due to L. S. and R. Pen- of the University of London, is a ding staircase that seems to go ever vard while at the same time closing n itself after each circuit.

The other, due to Shepard, is a tone seems to go ever upward while at same time remaining near the middle the scale. Figure 9 is a frame from movie.

The future—It is now several years e films were first animated by com- r (some computer films are known have been made on the Whirlwind nputer at MIT in 1951). However, have made relatively little impact, cially in science education where r prospects are perhaps brightest. bably the reason is the lack of a ble champion.

s I have indicated above, most of development has been in industrial ratories, where the interest has been traightforward technical applications computer output device. Very little work has been done at universities, and that which has been done has also been aimed at scientific rather than educational research.

To exploit the full educational potential of computer animation will require the partnership of three specialities: computing, film-making, and the subject-matter science or technology about which a film is to be made. A central facility where these skills could come together would give the educational uses of computers a great push forward. So far no such facility exists.

Another need is for higher-level computer languages. We have already seen an example of a computer language in Fortran, which allowed us to write formulas to program in terms of symbols rather than numbers, and to name sequences of instructions as subprograms.

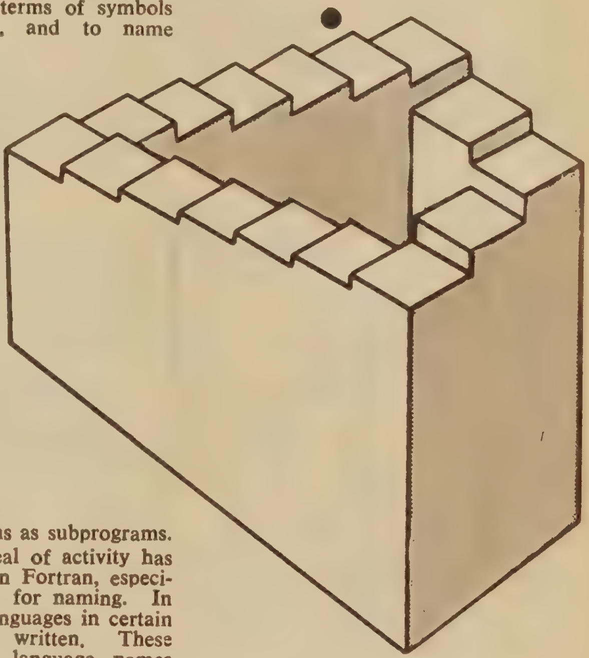


Figure 9: Ball bouncing along an impossible staircase. From "A Pair of Paradoxes," which combines the Penrose and Penrose visual illusion with the auditory illusion of R. N. Shepard

Recently, a great deal of activity has gone into improving on Fortran, especially in the mechanism for naming. In particular, computer languages in certain specialities have been written. These contain, built into the language, names for the concepts and operations peculiar to that speciality.

Such a language for movie-making would be very useful. It would contain convenient ways of specifying and moving objects mathematically and ways of projecting the object into a picture plane; it would allow the programmer to imagine himself as a cameraman with commands for panning, zooming in or out, dissolving, fading, etc.

A big first step in the direction of a universal movie language has already been made. K. C. Knowlton of the Bell Telephone Laboratories has written a language for movie making called BEFLIX which allows one to do many of the things mentioned. Figures 2 and 3 illustrating computer animation are taken from a 17-minute movie made in BEFLIX entitled **"A Computer Technique for the Production of Animated Movies."**

The instructions in BEFLIX look quite different from those in Fortran. An example is:

PAINT, A, B, WRITE, 2

which says: "Paint the rectangular area specified by the opposite diagonal points A and B. First erase what is now in this area and then write in 2s." By filling rectangular areas of the screen with various alphabetical and numerical characters, Knowlton generates the different textures of grey shown in figures 2 and 3.

Unlike the satellite and orbit examples of figure 1 and figures 4-6, each frame of which was a line drawing, a frame of a film in BEFLIX is completely filled with varying shades of grey. Thus, BEFLIX is more akin to the scanning technique of television. BEFLIX can be easily learned in a few weeks by persons with no knowledge of mathematics or computing.

Special-purpose computer languages are attempts to make easier the specification of image inputs to the computer. Another recent development in this direction is the light pen, the stylus-like device that allows one to draw computer-recognizable pictures on the face of a cathode ray tube. The combination of the light pen and special-purpose languages is perhaps the ultimate in a graphical man-machine communication system—one which is still in its infancy.

The future for computer animation is, in my opinion, very bright. It is, however, too early to tell exactly what its impact will be, especially in science education. Here, the computer does best the animation that is couched in mathematics—precisely the animation that is hardest to do by hand. So hard, in fact, that only a few examples of it have been tried in the classroom. We therefore have little experience with which to predict the future.

But all those who have tried computer animation so far are excited by its possibilities. I think their expectations will be more than fulfilled.

Author's note—Some of the films mentioned are available on loan from the Technical Information Library, Bell Telephone Laboratories, Murray Hill, New Jersey, U.S.A. These are all 16 mm films:

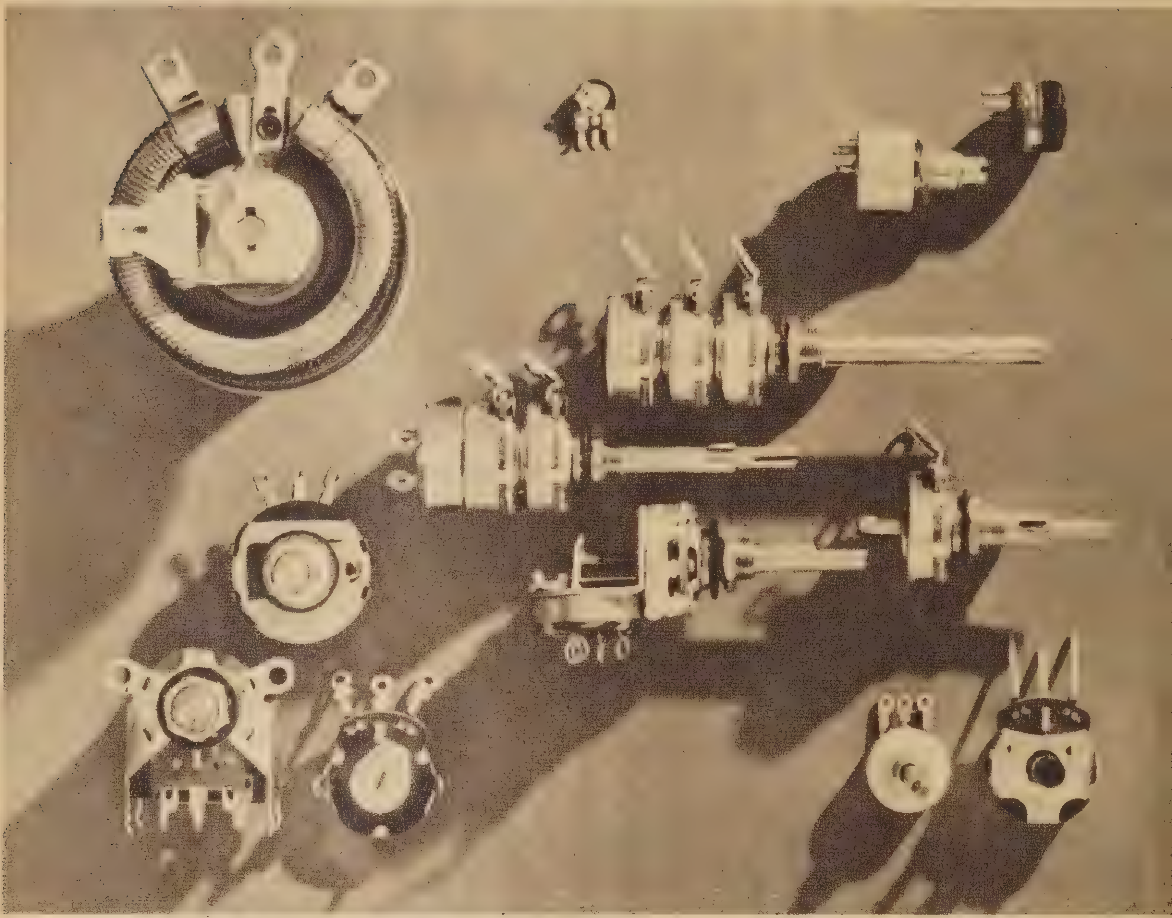
"Simulation of a Two-Gyro, Gravity-Gradient Attitude Control System" (4 min, sound).

"Force, Mass and Motion" (10 min, sound).

"A Pair of Paradoxes" (2 min, sound).

"A Computer Technique for the Production of Animated Movies" (17 min, silent).

PLESSEY



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LECTRONIC ISH SCARERS

Electronic fish callers are used often by fishermen to lure fish to their destruction, but now scientists in the U.S.A. are working on the opposite—fish scarers to keep young salmon out of danger spots.

Salmon may get a new lease on life because of scientific dies being conducted by Boeing for the United States h and Wildlife Bureau of Commercial Fisheries.

The studies involve the use of underwater vibration to ghten fish away from danger spots such as pumps, turbine akes on power dams, and irrigation sluiceways. If an derwater vibration device would guide young salmon past tential death traps, it could increase the value of catches mature fish by millions of dollars.

Louvres or fish fences could be built for this purpose, if adopted for general use on North-west river systems, cost would be prohibitive.

Fingerling losses have been a grim reminder that trifling h the environment of a natural resource is a tricky busi-s. Natural attrition on salmon eggs and fingerlings leaves small margin for successful propagation of the species. y additional man-caused attrition can seriously affect size of subsequent runs.

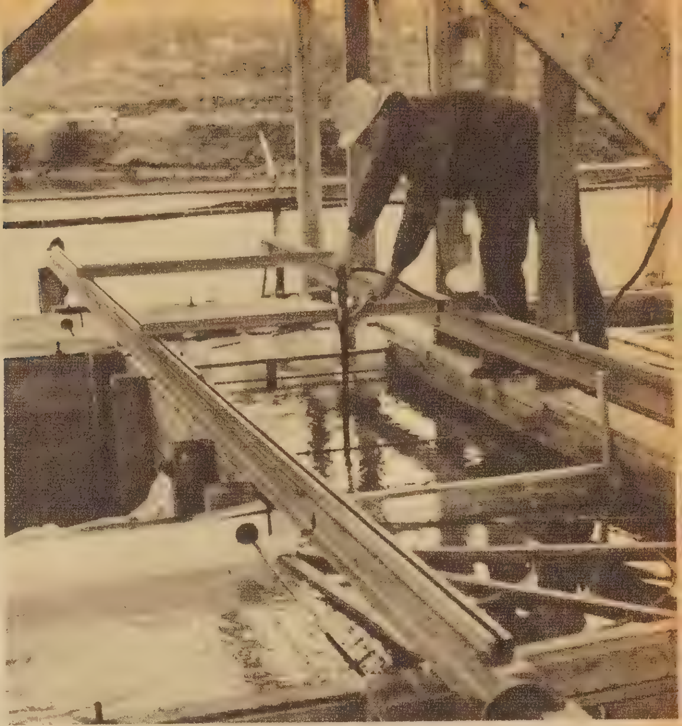
Chinook salmon runs already are at a precarious low. far it has been impossible to make a significant improve-nt in this situation, despite various conservation roaches.

Since Boeing uses vibratory equipment in its laborator- to test aerospace components, the Fish and Wildlife Ser- asked the company to conduct a research program to ermine what actually happens when fish are exposed to ration.

Considerable research is needed to determine the partic- levels of vibration most effective as fish frighteners, and ether a particular vibration frequency for specific fish—ed the natural resonance—would affect the entire fish, tain internal organs of the fish, or even fish of different s and different species.

For example, if a certain frequency would affect only air bladder of fish, this might cause them to rise to the face of the water where they could be guided safely past anger point.

The studies at Boeing are being conducted with finger-s (young fish three to six inches long) placed in an end- wooden trough of water about 3½ feet deep and 4 feet e which forms a rectangle. The vibration equipment is ted inside the rectangle. Water is pumped through the ugh to simulate the flow of water in a stream. The fish lie in the water with their heads pointing "upstream" until alarmed by sonic vibrations. Their efforts to escape the vibrations are carefully observed when they break their pattern.



Biologist John Van Derwalker adjusts a sonic probe in a leg of the rectangular wooden trough where the fish are kept.

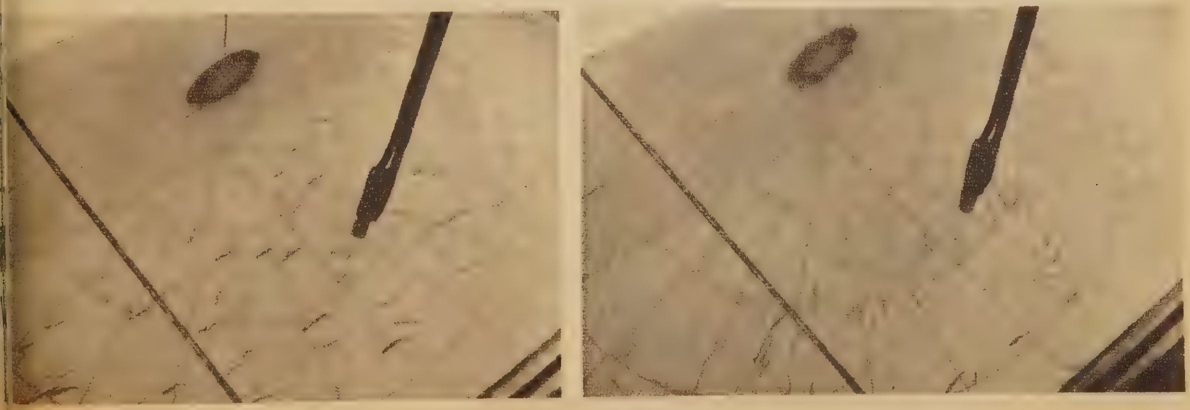
Specific test areas in the tank are subjected to vibrations and monitored to determine the frequency and decibel level that causes fish reaction to the sound. Motion-picture photographs of fish reactions are taken during the tests and data is verbally recorded on magnetic tape.

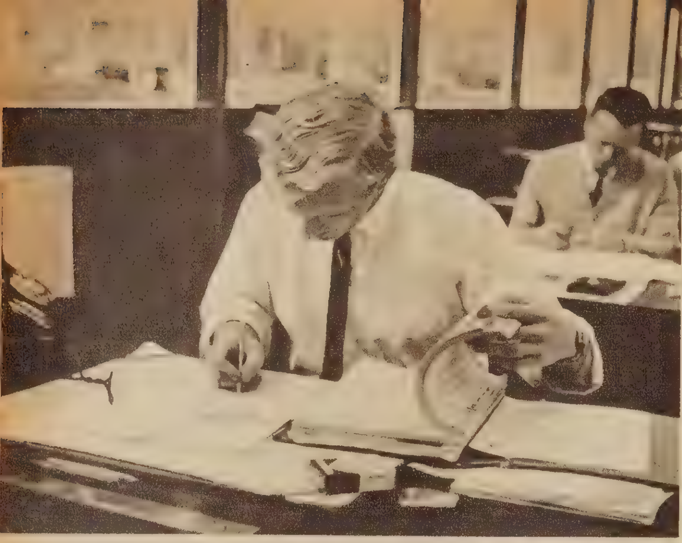
About 100 fingerling Chinook are in a typical test group. During a three-week test program they are subjected to a multitude of sonic vibration levels and frequencies. Preliminary results indicate the fingerlings show their first reaction when the frequency reaches 25Hz and 150 decibels. The tests will continue with gradual scaling up to 500Hz and sonic levels of 110 to 150 decibels. There is some indication that pulsed vibrations are more effective than a steady input.

"All we need is an effective range of 3 to 4ft and we'll have our technological breakthrough," says Boeing test engineer Melvin Mackey. "This would give us a range of 6 to 8ft if a sonic vibrator were mounted on each side of a pump, water inlet or sluiceway."

Some cynics have said that because of dams, pollution, fishing pressure and destruction of water sheds, aquariums will be the only place where our descendants will see live salmon. This view may be overly pessimistic, as scientific and technological advances have a way of solving problems that at times appear insoluble. There is hope that the spin-off from space-age research will help preserve a valuable natural resource on earth. ▬

elow (left): Small Chinook salmon all face into the urrent flow, ignoring the silent speaker and (right) catter in all directions as speaker emits vibrations.





Customer relationship with Ducon Industries Ltd., and their computerised management system begins here. Clerks receive mail and telephone orders and add to them supplementary information, which will assist the Electronic Data Processing department.

A card selection clerk starts the process of turning the computer's order into input for the computer. From a "tub" of color-coded cards, some blank and some pre-coded with information relevant to the customer and product a card-set is made up.

DUCON COMPUTER

At Ducon Industries Limited, one of the Plessey group of companies, an IBM computer has taken over much of the tedious recording and accounting involved in the production and of small electronic components. It does the job with speed, precision and to an order of detail beyond the capacity of clerical staff.

Although a vast amount of EDP—Electronic Data cessing—equipment is being brought into service throug Australia, our manufacturing organisations are still relat inexperienced in the use of computers to assist in the ning and control of production. However, firms which take the plunge early are finding that they are now begin to recoup the costly outlay on data preparation and plann which the installation of a computer system requires.

One of the first in the field was the Plessey compor company, Ducon Industries Limited, which is now more half way through a five-year plan for a "complete man ment-operating system" for its 17½-acre plant at Villaw near Sydney. The Ducon management calculate that they now "breaking square" with their computer, which costs an hour of operating time.

It is engaged on 149 separate daily, weekly and mor tasks preparing sales analyses, debtors' statements, pro tion orders and invoices. On June 30 this year, for insta it did the bi-annual stocktaking in a mere five hours, del ing to the auditors a complete list of all stock on han standard cost and written-down value.

Next day, it produced taxation group certificates for plant's 1,800 employees as well as handling some 15 rou chores!

In another six months a management system wil forged out of the many independent controls now in use the three main divisions of labour, material and overhea will take about two more years to integrate this manage system with a cost control system.

The application of computer techniques to the req ments of a component and capacitor plant with a rang 27,000 products has been an arduous operation calling foresight, education and co-operation. Planning began an appreciation that the major problem would be mate control. Nearly one third of the total range of products current in any one year. The plant must hold all parts f many as 8,000 products at the one time.

This consideration dominated the firm's choice computer—an IBM 1440 model which had 8,000 posi of core storage memory, a card reader as an input d capable of reading 400 cards a minute, a printer wi printing capacity of 300 lines a minute, and two disc d to take interchangeable disc packs. Each pack has a sto of 2 million alpha-numeric characters of data in 20 sectors, each of 100 characters.

These sectors are individually addressed and car retrieved by the computer in sequence or at random. advantage which this random selection confers was sidered a major advantage in an industry where only

Left: Variable customer requirements of delivery and charging are punched into 80-column card-sets at about the same speed as a typewriter. The time spent on checking and coding data up to this point is the most expensive part of the system but the data can be used over and over again for internal planning and control and for better customer relations.

Far right: The customer order summ which is a complete record of all duction orders for the customer, c via the computer disc packs to the sional sales section. Any enquiry a customer about the progress of order can be quickly answered by rence to this summary.

CONTROLS ACCOUNTS, WAGES, STOCKS

ut of 9,000 items on the computers' master records might move" in any one day.

To cater for expansion, the Ducon planning team ecided to modify the computer by adding another 4,000 ositions of core storage and another disc drive. Two special eatures "direct seek" and "scan disc" were installed on he computer to speed up retrieval of data from the disc acks.

At the appropriate time, the company organised three eries of lectures, attended by 30 key personnel each, to et the message of the computer's use across to production, ngineering, accounting and sales departments. The basic heme was: "Computers are fast but docile morons, which o only what they are told and nothing more!" Education f the work staff stressed that information coming into the omputer had to be 100 per cent correct or the computer ould not process it.

Ducon's Electronic Data Processing department claim lmost total success with their education program, because here are now very few instances of incorrect data arriving t the computer from any part of the plant.

When a customer's order is being processed, divisional ales departments first scrutinise the orders to see that all he necessary information is clearly marked, so that the ey punch girls and card selectors in the Electronic Data rocessing department can quickly prepare the order as nput for the computer.

Colour plays an important part at this vital stage of he operation, where an error can be perpetuated through he system. The Ducon planners found that the E.D.P. orkers could manage far better if certain key categories f information were indicated by coloured cards. So, blue ards are "charge to customer," yellow cards are "consign- ent other than customer," and so on.

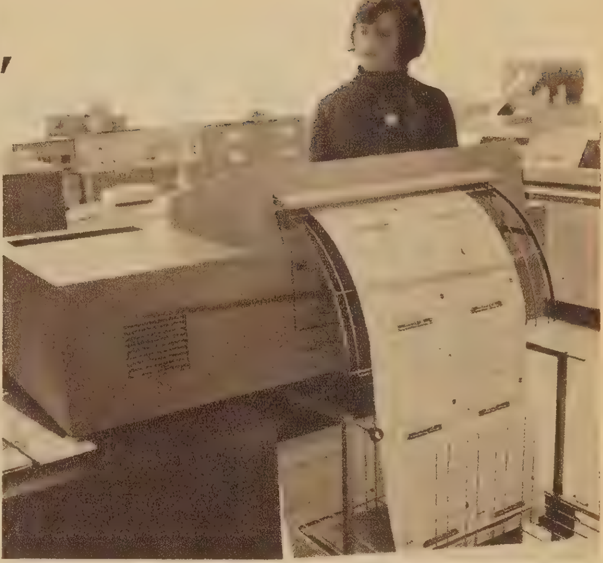
A card selection clerk makes up a set of cards for each rder. The set of cards contain: (1) a name and address card elected from an indexed file of pre-punched cards to match he name and address of the customer to be charged. (2) If elivery is required to another address, a blank card is placed ext in the set. Two cards for each delivery of each product ust next be selected (3) a card with a pre-punched reference umber to give the production order an identifying number nd (4) a card selected from a file of pre-punched product escription cards.

This system of using pre-punched cards eliminates the ecessity to identify customers and products on the original ocument with the machine codes, when the product descrip- on is not directly acceptable for machine processing.

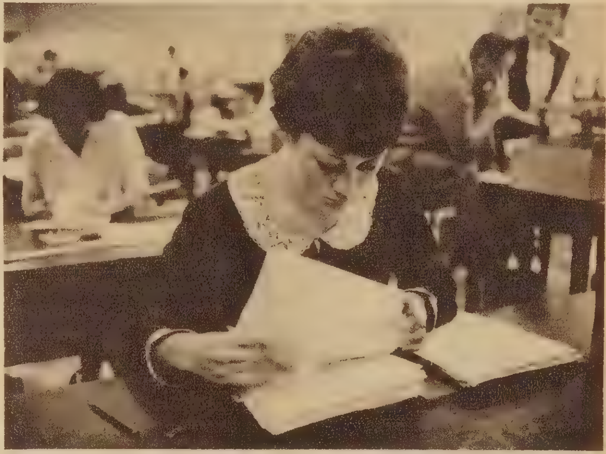
The sets of cards then pass to a checker to see if the ght cards have been selected and that the cards are in the me sequence as the documents. The card sets are then rocessed to take in the variable information on the order. he name and address card is allowed to pass the punch ation until it is under the reading head. The machine is so ned that, when column one in the name and address card under the reading head, the first column in the next card under the punch head. This allows information in the first rd to be duplicated into the following card simply by riking the duplicate key. The extent of the information to duplicated is governed by the program the punch operator as used.

A customer's number is duplicated from the customer me and address card into the delivery address card and e full delivery address punched. The card coming next to e punch head is the one with the pre-punched serial num- r. The customer number is duplicated from the delivery dress card; then customer's or agent's order number, livery or special instructions, the date the order was re- ived and delivery data required are punched into the card.

Next comes the product card with the description pre- nched so that only such variable information required by



The computer processes the cards, turning out production orders for the factory and also recording the data for storage on disc packs. The computer will, if required, print out invoices with calculations of quantity, price, discount and sales tax.



In the divisional planning section, the production order, from the computer, is filed in production order sequence. Copies of the order are used as production-to-store dockets, when manufacture is completed, and to collect goods for packing at the despatch store.

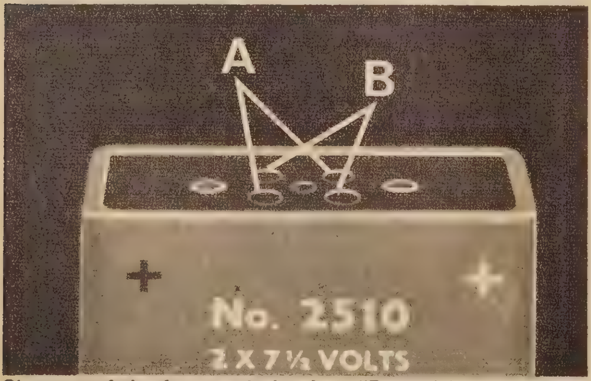
Union Carbide's unique dual voltage batteries...and their advantages

'Eveready' batteries have available a range of dual voltage batteries providing the higher voltages preferred for Silicon transistor equipment.

Each battery actually consists of two separate batteries in a metal case. There are four terminals, allowing the circuit designer a choice of series or parallel connections. Thus, from the three batteries in the range, there is a total choice of six different voltages — 6, 7½, 9, 12, 15 and 18 volts. The series connection provides for a centre-tap.

A dual voltage battery allows for greater simplicity in circuit design. These batteries are ideal for use in portable radios, portable car radios, O.T.L. amplifiers, and high frequency industrial and medical transistor equipment.

The batteries all use the famous Mini-Max construction, developed by Union Carbide. This has many advantages in transistor applications. It leakproof; it has a simple plug and socket co nection—without any chance of reversed polarit it makes for cheaper tooling, as no special contac are needed; it gives higher volumetric and weig efficiency, and the batteries are easily available.



Close up of the four terminals of an "Eveready" dual voltage battery. "A" and "B" are the separate connections.

+
No. 2510
SPECIAL
EVEREADY
TRADE MARKS
TRANSISTOR
RADIO BATTERY
LEAKPROOF
ANOTHER
PRODUCT
MADE IN AUSTRALIA

One of the range of 'Eveready' dual voltage batteries. This is the 2510, giving a choice of 7½ or 15 volts. Others are the 2512 for 9 or 18 volts and 2582 for 6 or 12 volts.

FOR FURTHER DESIGN INFORMATION WRITE TO:
Union Carbide Australia Limited,
Box 5322, G.P.O., SYDNEY
marking the envelope **'Battery Engineering'**

EVEREADY Products of UNIO CARBI
TRADE MARK
BATTERIES

"Eveready" and "Union Carbide" are registered Trade Marks ·

E7

order need be punched. Into this
d are punched the customer number,
duction order number (duplicated
m the previous card), the date of
iching, the week and day number the
tomer requested delivery, quantity
l sales tax code.

'hese sets of cards are then passed to
ifiers to check the accuracy of the
ich operators and highlight any errors.
Although this preparation of data
ears very time consuming and expen-
, it is surprising how the cost can be
ified because of the several ways in
ch the information can be used. In
, one of the basic laws of computer
ge is that it is seldom economical to
ive only one result from one set of
rmation.

erhaps the most startling example of
way that Ducon planners have been
to re-use basic information is in the
d of payroll accounting.

From one simple input—a worker's
kly work sheet—they have been able
produce 22 different lists of company
istics. These range from a daily pay-
hours control to a weekly summary
individual earnings, which must be
d for seven years to satisfy legal
uirements.

t is essential to store as much input-
a on disc, when reading the cards, to
duce a first report and, later, to use
stored information at high speed for
further jobs. From card reading only
000 characters per minute are avail-
e to the computer; from disc storage,
000 characters per second are made
ilable to the computer for processing.

Card sets are passed to the computer
m where they are batched twice
ly for processing on the computer to
duce production orders for use in the
tory. While these are being printed,
data is being recorded on a disc pack
facilitate further reports such as the
stomer Order Summary" (a summary
all production orders produced for
customer) and a daily order intake
analysis of the orders in product
uence, showing quantity and value of
h product ordered in that batch).

The card sets are then sorted into
es on a card sorter capable of hand-
2,000 cards per minute. The
tomers' name and address cards are
urned to the indexed file in the punch-
m, the delivery address cards are
troyed and the product order card is
roduced on a Reproducer as a sales
d containing all the information ex-
t quantity. These sales cards are kept
production order number sequence for
oicing.

'he production order is sent to the
sional production planning section
filing in production order sequence
that, when manufacture is completed,
copy of the production order can
used as a production-to-store
ket.

'he customer order summary is de-
red to the divisional sales section for
g behind the customer's order. This
s them a complete record to check
queries that may arise.

a customer enquires about delivery,
ting his order number, the sales clerk
turn up the order and find filed be-
it the customer order summary
h shows the production order num-
for each requested delivery of each
luct. The clerk can then ask the pro-
planning section about the progress
ne production orders.

t the dispatch store, goods, accom-
ed by the copy of the production order, will be gathered on up to six production orders for the same customer. A delivery docket, quoting the production order numbers is typed and a copy sent to the card selection clerks in E.D.P. who extract from the file of cards awaiting invoicing the production order numbers mentioned on the docket.

These cards are checked to see that the description of the product agrees with the description on the delivery docket to ensure that the right production order number has been quoted. The cards are then passed to the punchers and verifiers to have the quantity being delivered, delivery docket number (which now becomes the invoice number) and date punched into them.

The cards are used as input to the computer for the printing of an invoice. The "customer master" disc is used to get the name and address for printing on the invoice.

Calculations of quantity, prices, discounts, sales tax and invoice total are performed by the computer, which not only prints these on the invoice but also records on a disc pack the necessary information to supply the monthly accounts department with a summary of all these sundry charges, the summary of the total sales quantity and value for each product and the summary of the quantity and value of each product sold to each customer. An "exception" report which only prints the products whose sales exceed $200 per month is also produced .

The amount of the invoice total is recorded on disc, as is the outstanding opening balance of a customer's debt for one month. By combining these with any cash payments, which are punched into cards, the debtors' statements and aged debtors' analyses are produced.

This is the way a computer has been adapted to the needs of a management system for the major producer of electronic components in Australia.

At the point of dispatch. Women workers gather and pack goods from up to six production orders for the same customer. All along the line personnel have had to be educated to adapt to living with a computer which in the long run will make their work less complicated.

Phase Two of the system is now well into detailed planning. This will break into the present system at the point where a production order has been prepared and the order recorded on disc pack.

The final phase, already planned in broad detail, will mean the integration of the first two phases with a cost control system to highlight variations from standards, labour and material within a day of their occurrence. An employee will, for instance, record the batch number of a particular order on his time sheet. This will allow the computer to store actual times against each batch and compare them with a standard. The day reported.

Ducon planners are confident that almost every foreseeable condition has been allowed for. They claim that no emergency demands on the system will upset it, provided they are handled in the proper way. There are many theories about the use of computers to assist management in production planning and control. At Ducon's Villawood plant, theory is becoming a commercial reality.

Link with lost tribes

An S.T.C. team has recently completed the installation of a radio transmitter on the small island of Daru, south of New Guinea. Communication has now been established with many native tribes previously lost to civilisation except for the occasional visit of a patrol officer. S.T.C. engineer, Alec Kennedy, and fitters, Peter Herrig and Len McEwen, from the Radio Transmission Division, installed and commissioned the 10KW HF broadcast transmitter and three 250-watt communication transmitters for the New Guinea Department of Posts and Telegraphs.

The island of Daru is aproximately two miles off the south coast of New Guinea, almost opposite Cape York, and measures roughly two miles by one mile wide. It has a population of 120 Europeans and 3,000 natives and is the centre of the Western District Administration.

Radio receivers in these villages allow the local population to listen to Radio Daru, which broadcasts in Kiwy, Pidgin, Police Motu and English.

Radio Daru's one-room studio is situated in the town, one mile from the transmitting station, and controls the transmitter by a remote control unit. The station is administered by the Department of Information and Extension Services, which draws up the programs and operates the transmitter.

NEW PRODUCTS FROM

Mullard

FURTHER RELEASE OF N-P-N SILICON PLANAR EPITAXIAL TRANSISTORS

Mullard's latest n-p-n silicon planar epitaxial transistors, types BSX19 and BSX20, have been designed for use in either high-speed logic switching circuits or HF amplifiers. These new transistors have the high performance, reliability and ruggedness associated with planar epitaxial construction. Both devices have extremely short switching times, 10ns (max) and 13ns (max) respectively.

In switching circuits optimised for high-speed operation, propagation times of 5 to 10ns can be obtained. However, the voltage ratings of these transistors enable slower speed (50 to 100ns), high noise margin (2V), DTL circuits to be designed to work from a 12V supply.

The versatility of these transistors is such that they are also suitable for use in HF amplifiers. Their high gain and high cut-off frequency make them particularly suitable for roles in transistorised mobile and portable HF and VHF telecommunication equipment where an output power of 500mW with a gain greater than 10dB can be readily realised.

The BSX19 and BSX20 fully meet JEDEC specifications 2N2368 and 2N2369 and, if required, can be supplied with these JEDEC references marked on the can. Both transistors are in TO-18 encapsulation.

UPRATING AND EXTENSION OF 18kW RANGE OF AVALANCHE POWER RECTIFIERS

As a result of rigorous and extensive life testing, th forward current ratings of rectifiers in the Mullar BYX25 series have been uprated to 20A at a stud temperature of 125°C. As this new current rating i achieved without any increase in price, the cost o devices in this series has been effectively reduced b 40% when considered on a volt/amp basis.

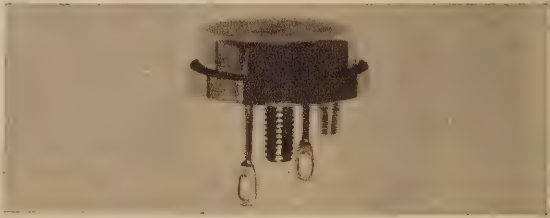
The BYX25 series has also been extended to include 1000V crest working rectifier, type BYX25—1000 (an type BYX25—1000R—reverse polarity version). Th increased avalanche voltage of this new rectifier wil allow considerable savings to be made in the construction of higher voltage stacks because fewer diodes wil be required to provide a given safety factor.

All devices have an 18kW avalanche power rating an can also accommodate a 360A peak one-cycle surg (50c/s). These factors make this series particularl suitable for high-voltage power supply applications i transmitters and similar equipment.

SILICON PLANAR TRANSISTOR FOR HF TRANSMITTERS

Another Mullard semiconductor release is type BLY17 an n-p-n silicon planar transistor for use in AM, FM and SSB transmitters in the HF band. A pair of thes transistors will deliver 80W of FM carrier power a 30Mc/s from a 40V supply line. Operating from a 24V supply, 45W of AM carrier power can be obtaine in the 1.4 to 1.6Mc/s band. In SSB applications, a single BLY17 gives 20W peak envelope power with inter-modulation products 30dB below carrier.

The major ratings and characteristics of the BLY17 are given below.



V_{CB}max	100V
V_{CE}max	100V
I_{CM}max	10A
$I_{B(AV)}$max	2A
P_{tot} (total dissipation, T_{case}=25°C)	100W
θ (thermal resistance junction to case)	1.5°C/W

Mullard-Australia Pty. Ltd.

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M

MICROWAVES ACROSS THE NULLARBOR

As announced recently in the daily Press, the P.M.G.'s Department has signed a contract for the installation of a microwave link across the Nullarbor Plain to link Western Australia with South Australia and the eastern states. Here are some additional details released by the P.M.G.'s Department.

Construction of this new east-west ystem, one of the world's largest single aicrowave radio links, will start almost mmediately and will take about three ears to complete. It is estimated that he cost of this valuable national project ill exceed $8,000,000.

G.E.C. (Australia) Pty. Ltd. will be esponsible for the supply and instalation of the whole system, including adio equipment and channelling, towers, ower plant, and buildings.

The original plan was for the instaltion to be completed by August, 1970. Iowever, because of the rapid growth f telecommunications traffic between Vestern Australia and the eastern states, hich reflects W.A.'s rapid developent and Australia's participation in .S. space projects, it is now planned to omplete the system almost 12 months head of the original target.

The 1,500 mile link will start at ortham (W.A.) and go via Kalgoorlie Norseman from where it will follow e Eyre Highway to Kimba, and then rough Whyalla to the terminal at Port irie (S.A.).

The system initially will comprise a ain channel and a standby channel, ich capable of carrying up to 600 teleone circuits or an each-way television lay. It will be capable of extension up to four additional channels of e same capacity—which can be inalled as traffic increases warrant it.

As well as catering for "through" st-west traffic, the system will prode additional telephone circuits for erredin, Kalgoorlie, Norseman and eduna. Circuits could be provided also r the Eyre Highway settlements, inding Caiguna, Eucla and Madura to ovide a better service than that availle now.

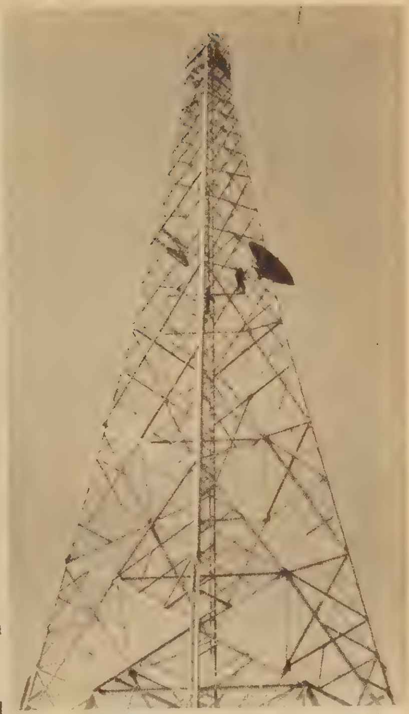
With the completion of the east-west system Australia will have a network of large capacity microwave radio links and coaxial cable systems stretching from Cairns to Hobart and from Melbourne to Perth. These large capacity systems are an integral part of Post Office plans for subscriber trunk dialling and will give Australia the potential for nationwide television relays.

Adelaide and Perth were first linked by telegraph just on 90 years ago, in 1877, via a single iron wire along the Eyre Highway route. Inter-colony transmission of telegrams required at the time that all messages be transferred by hand betwen the South Australian and Western Australian operators at the telegraph repeater station at Eucla. A further telegraph link was later established with the transcontinental railway line. It was on this link that the first trunk telephone circuit between Perth and Adelaide was introduced in December 1930.

Fifteen years ago there were five telephone circuits between Perth and the Eastern States. Five years ago the number was 28. Since than an additional 30 circuits have been added and work is proceeding to increase this number progressively with a target total of about 120 circuits by the end of 1968.

It is expected that by 1970 the annual telephone traffic between W.A. and the eastern states will reach 1,000,000 calls. To handle this, plus telegraph and data transmission traffic, 150 circuits will be needed on the transcontinental link by that time. It is estimated that this requirement will double every six years or so thereafter.

The new system was chosen after very careful consideration of the relative merits of microwave radio and coaxial cable. It will be a further development of long-distance microwave links now being installed or planned for other parts of the world and has been specially designed and engineered to meet the unique requirements of the route.

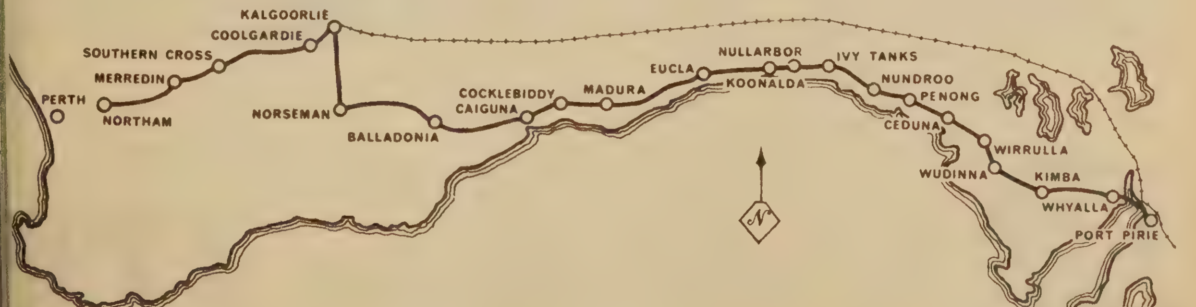


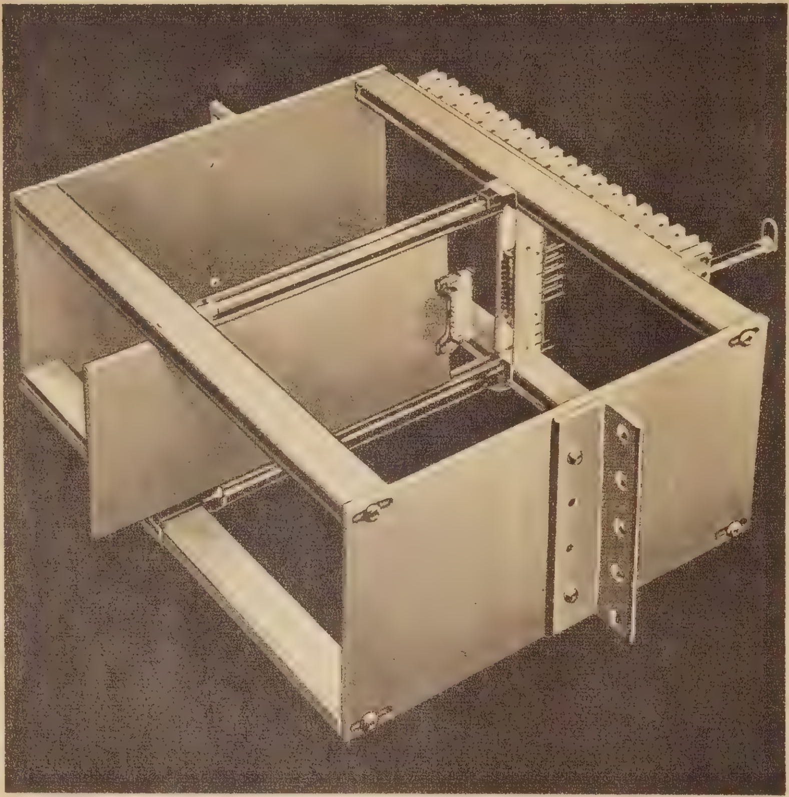
One of the 250ft towers which will form part of each repeater station. An aerial with parabolic reflector is shown being placed in position.

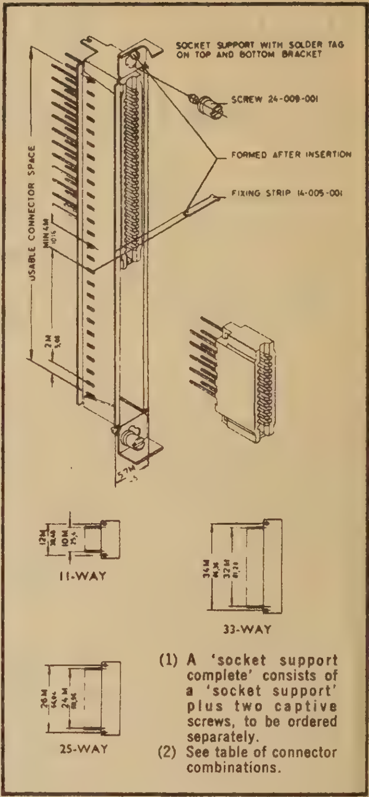
Traffic will be relayed through repeater stations set at 25-mile intervals along the route. These stations will be easily visible from the Eyre Highway. The circuit between repeaters will be on a line-of-sight basis beamed from towers up to 250ft high. Each repeater will have such a steel tower with aerials at the top, fitted with parabolic reflectors 12ft in diameter.

In all, 61 towers will be needed and these will be constructed for G.E.C. by Electric Power Transmission Pty. Ltd.,

The route of the proposed Nullarbor microwave link. This is essentially the same route as that of the single wire line of 1887, and also the present Eyre highway.






SOCKET SUPPORT WITH SOLDER TAG ON TOP AND BOTTOM BRACKET
SCREW 24-009-001
FORMED AFTER INSERTION
FIXING STRIP 14-005-001
USABLE CONNECTOR SPACE
MIN 4M
2M
11-WAY
33-WAY
25-WAY

(1) A 'socket support complete' consists of a 'socket support' plus two captive screws, to be ordered separately.
(2) See table of connector combinations.

ISEP

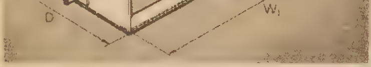
Low-cost Modular Mechanical Mounting and Connecting System

ISEP (International Standard Equipment Practice) has been developed by ITT to provide a low-cost, comprehensive system of racks, sub-racks, plugs, sockets and accessories for the housing of electronic equipment.

ISEP is manufactured and marketed by STC and can be supplied to meet exactly the requirements of equipment manufacturers.

The ISEP modular system offers the ultimate in simplicity and flexibility in sub-racks. It is assembled with four screws; guard rails and socket supports are fixed into the sub-rack by four special screws. Plugs and sockets are rated at 250 V. r.m.s., 4 A. per connector, have a contact resistance of less than 5m Ω and meet the highest professional specification. Whether mass-producing or making equipment to special order, you can obtain the benefits of high quality at low cost by using ISEP.

For illustrated technical booklet, write to: Standard Telephones & Cables Pty. Limited, Components Division, Moorebank Avenue, Liverpool, N.S.W. (Phone 602-0333).


WF
HSR
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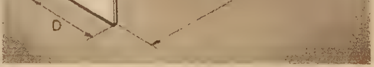
D
W1

Four-Rail Sub-Rack


WF
HSR
VF
DA
HA
D
W1

Two-Rail Sub-Rack

Typical Installatior

world-wide telecommunications and electronics

AN ITT ASSOCIATE

Sydney, who have built all Australian t Office (A.P.O.) microwave radio ers.

he radio equipment, chosen for high formance and low power consump- , will be of the very latest type ilable anywhere in the world. It will completely transistorised and operate a frequency of 2,000MHz.

On a route such as the east-west, with long distances between towns and mains power supply, power is a prob- . For this system, with its low ver consumption, the main source of ver will be wind-generators—an im- ved version of those seen on many al properties throughout Australia. In way, one of man's oldest sources of rgy—the wind—will be harnessed to of his latest inventions—the transis- sed microwave relay system.

At each repeater station, a diesel erator, supplied to G.E.C. by McColl ctrics Works Pty. Ltd., of Melbourne, stand by to cover windless periods.

novel type of repeater building has n developed by A.P.O. engineers for project. It will be of all-metal con- ction, completely sealed and without lation. Carefully designed sunshad- will protect it. Laboratory tests in lbourne and field tests at Kalgoorlie e shown that this type of building, h a sunshade, will ensure that the ipment inside can be housed within wable temperature limits.

ot only will these buildings be much aper than those of conventional k construction (in remote localities), they will permit the pre-installation equipment. This will mean, in effect, "packaged" buildings, complete with ipment, can be delivered from fac- to site.

.P.O. Engineering staffs have now pleted surveys of the route between tham and Norseman (W.A.) and veen Ceduna and Port Pirie (S.A.) have established sites for the repeater ons. The survey of the remainder of route, which will involve using aerial tography, will be carried out by the artment of the Interior.

ith a scarcity of data throughout world on the behaviour of micro- e radio beams over flat country such he Nullarbor Plains, the A.P.O. has ied out extensive radio propagation , using experimental stations at Ivy ks at the top of the Great Austra- Bight and at Kalgoorlie. Work is proceeding, using special equip- t and aircraft, to complete the re- ing of radio propagation results r all possible weather conditions.

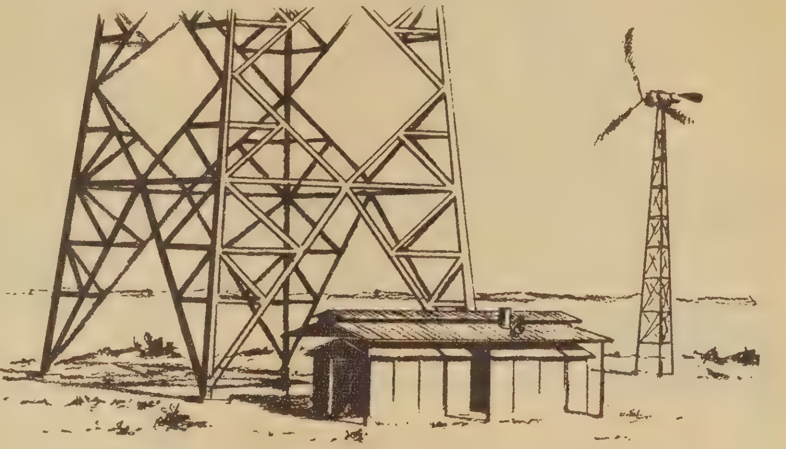
esent planning is for A.P.O. main- nce staffs to be stationed at Ceduna Norseman. Using specially equip- vehicles, the staff will travel up to miles to the furthermost repeater in territory, on their routine inspec- and servicing visits.

e Nullarbor link, although a large ect in itself, is only a part of the larger Australia-wide broadband ms. Plans are already well ad- ed to expand many sections of the dband system, to cope with antici- l traffic growth over the next few

part of this expansion, an initial of 60 telephone circuits will be ght into operation shortly on a new -capacity microwave radio trunk m from Adelaide to Melbourne. More circuits will be brought into operation later in the year to pave the way for Subscriber Trunk Dialling between the two cities and centres enroute.

A similar new trunk system between Melbourne and Launceston is expected to be operational by November this year. On this route delays would be reduced and the stage set for Tasmania/Mainland Subscriber Trunk Dialling.

The broadband trunk network has, at the same time, entered a further significant expansion phase along the more heavily populated eastern seaboard. A complementary microwave radio broadband trunk system is currently being built "in parallel" with the Sydney/Canberra/Melbourne coaxial cable system to meet anticipated rising demand for all telecommunications services, including data transmission, and also to provide alternative route systems.



An artist's sketch of a repeater station, showing the base of the tower, the wind generator, and the equipment building. Note the sunshade over the building which is designed to keep the inside temperature within acceptable limits.

A microwave system between Sydney and Canberra has already been completed and a section between Melbourne and Albury will be completed this year. The Albury/Canberra section is planned for completion within two years.

Work is also well advanced on the installation of a four-tube coaxial cable system from Newcastle to Taree, Kempsey, Coffs Harbour, Grafton and Lismore. This work is being done in progressive stages and by 1970 there should be two "parallel" broadband trunk systems between Sydney and Brisbane.

Further major broadband trunk systems should be established between Adelaide/Perth/Carnarvon and, possibly, Port Hedland, by 1970. By then, a network of broadband trunk systems will link every major population centre in every State with ample circuit capacity for all classes of telecommunication traffic, includin TV program relays.

It will represent a national communications asset of more than $80 million—providing customer facilities comparable with the best in the world.

Australia has also expanded its facilities for handling international traffic. The Postmaster-General, Mr Alan Hulme, announced recently that the Overseas Telecommunications Commission will introduce a computer-controlled method of processing international telegrams. Known as a message relay system, it will be a major development in Australia's international public telegraphic service.

Following world-wide tenders to O.T.C. Specifications, a contract for the computer equipment is being placed with the UNIVAC Division of Remington Rand Ltd., London. The overall project, which will be carried out in Sydney, will cost $1.8 million and is planned for completion by the end of next year.

Mr Hulme explained that message/relay is a technique whereby specially designed computers are used in telegraph operating centres to receive messages and switch them automatically to the required outgoing channels as soon as these were available. Allocation of a message to a channel, the order of priority of its transmission, and safeguards against its loss are determined by the computers from information contained in the message itself.

He said studies by O.T.C. have shown that the message relay system will substantially improve the speed and reliability of service to the public, facilitate the interconnection of Australia's international circuits with the domestic network for the collection and delivery of international traffic, and reduce operating costs.

It will also reduce the time taken to retransmit messages passing through Australia from an overseas source to another overseas destination. Transit traffic of this nature, handled on behalf of other countries, assists O.T.C. to earn export income for Australia.

Mr Hulme said that the saving in operating costs will help maintain the stability of international telegraph tariffs which the Australian public have enjoyed for many years, despite rising costs.

He added that a feature of the system will be the use of television-type display units in place of conventional teleprinter equipment. It is believed that this will be the first application of this technique to an international public telegraph service, here or overseas. ■

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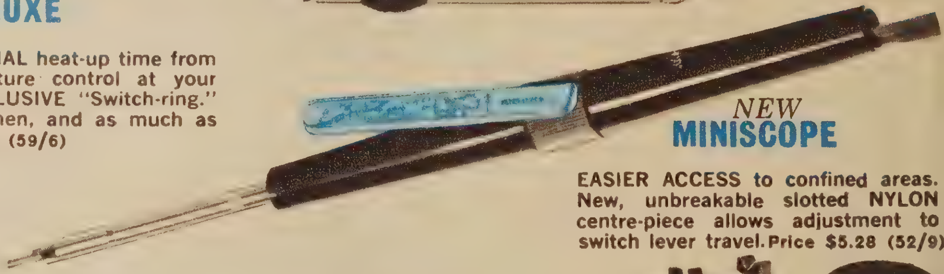

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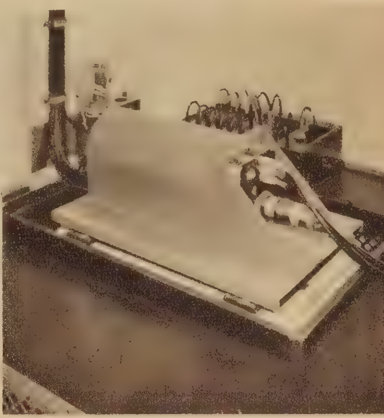
MEASURING TIME IN MILLIONTHS OF SECONDS

For centuries, man has based his divisions of time on the rotation of the earth. While this method of measuring time is still sufficient for everyday purposes, the extreme precision required in some fields of science today demands much more accurate methods.

By Stanley White



Above: Precision Time Standard which governs Greenwich Mean Time at the Royal Greenwich Observatory. Below: The Time Room at the Royal Greenwich Observatory.

For most of us a difference of a few seconds either way is not a matter to worry about except when it means that the train we hoped to board has just drawn out of the station without us. But as civilisation and the sciences have developed there have arisen many activities for which time has to be exact, to the extent that variations even of millionths of a second or errors of the same magnitude in measurement can be of major importance.

Consider the time-calculations which must be made to enable two space vehicles to rendezvous, both travelling at about 25,000 miles an hour but eventually stationary (in a relative sense) within a short distance of each other. Or the precision involved in ensuring that a lunar probe could be dispatched not only to hit the Moon but to land at a predetermined spot.

There are three general time standards in use. Universal Time or UT is that shown by our watches. Ephemeris Time (ET) is used by scientists, particularly astronomers, and Atomic Time (AT) is now becoming the practical time standard for use where high precision is essential.

Universal Time is worked out from he rotation of the Earth on its axis, and a second is defined as 1/86,400 of the mean solar day. But it is not so simple as that, for this time scale, known as UTO, does not allow for small shifts of he Earth's axis within its solid body. When corrections are made for this, a ime scale known as UT1 is evolved, and when further corrections are made or seasonal variations the result is UT2, more generally known as Greenwich Mean Time (GMT), the standard used y the whole world for setting clocks nd watches, for navigation, survey work nd satellite tracking.

This means, in effect, that GMT serves s a kind of reference for the right time t any moment during the day. But it oes not mean that it can produce a onstant second of time; that is a second which, if remaining in continuous use, would be a correct unit in, say, 50 years' me. The reason is simply that the average length of the solar day changes rom year to year, because both the rotational speed of the Earth and its internal constitution are steadily, if slowly, hanging.

There thus has to be a method of etting a more uniform scale of time, amely by ET, based on the revolution f the Earth around the Sun; and AT, ased on molecular and atomic resonance.

The Ephemeris second coincides with e UT2 second, which was fixed at a rticular epoch, the definition being the action 1/31,556,925.9747 of the tropical year at the first moment of the ear 1900, a date chosen for complex astronomical reasons. Nevertheless a clock which had been set at this standard then and run constantly thereafter would have been out of step by about 30 seconds in 1965. Since the standard is determined from lunar observations it cannot be checked easily or rapidly.

The Atomic Standard (defined at present on a provisional scale as 9,192,631,770±20Hz of a caesium beam atomic standard) is for all practical purposes a better standard for time and frequency, does not require years of observation for comparison purposes and can he checked with something like 100 times the accuracy, a factor which may well be increased.

The difference between AT or ET and GMT is calculated each year and issued as a correction factor, last year's difference having been minus 150 parts in 10^{10}.

All of this gives a general indication that a great deal of complicated calculation is necessary to provide the world with GMT and associated correction factors and that the equipment used to ensure its accuracy has to be of the highest standard.

At the Roval Greenwich Observatory, now situated at Herstmonceux, Sussex, England, the standard time and frequency transmissions of radio stations in many parts of the world, all participating in the international co-ordination of time and frequency, are monitored continuously as part of the system enabling the British time standards, accepted widely as basic, to be broadcast by a General Post Office station four times daily.

It also enables the Observatory to supply the British Broadcasting Corporation by means of phonic motors over a landline, with a second line as a standby, with the "pips" used as time signals in B.B.C. broadcasts. The same svstem controls the clocks seen on television screens in U.K.

For monitoring purposes the Observatory has for nearly 10 years been using two Racal RA.17 receivers continuously,

(Continued on page 174)

FROM HOUR GLASS TO LASERS

This extract from a report on measurement systems from the National Bureau of Standards, in U.S.A., shows the development of time-keeping through the ages: "We begin in ages past with the hourglass, which kept time to about a second in a minute and a half; it probably cost $3 and was accurate to about a part in 100. Next we have the clock, which costs about $30 and keeps time to about a second in three hours or a part in 10^4. Next we have a tuning fork, accurate to a part in 10^5 and costing perhaps $300; then the quartz frequency generator, accurate to a second in three years, or a part in 10^8; the ammonia molecular clock, good to a second in 30 years, or a part in 10^8 or 10^9; then the new caesium resonator, accurate to a second in 30,000 years, or a part in 10^{12}; and finally the hydrogen maser, now under development, which may go to a part in 10^{14} at a cost of about $300,000.

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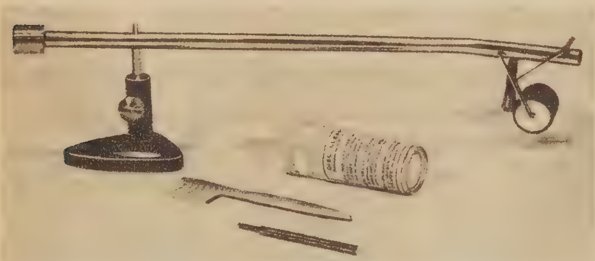

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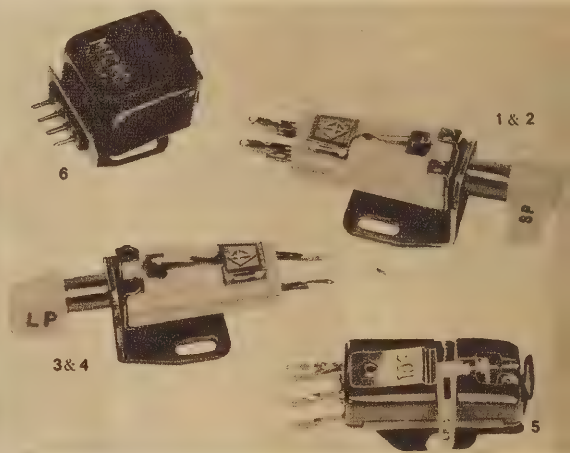

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Technical Review

READING AND WRITING WITH ELECTRON BEAMS

Making the currently used video and data recording and reproduction systems, using magnetic tape, look as out-of date as the Edison phonograph, new electron beam techniques now under development pack great amounts of information into a small space, record at frequencies of several hundred MHz and reproduce visual data with great clarity for television and radar.

Electron-beam recording, still a eveloping technique, has stored data densities and bandwidths far beyond ie capabilities of conventional record- ig methods.

One electron-beam system can pack million words—the equivalent of ree volumes of the Encyclopedia Bri- nnica—on about 800 square centi- eters of film. Another reads, transmits id rerecords facsimile data with a ndwidth of 20MHz. Others have re- rded at frequencies of several hundred Hz.

Besides offering 10 or more times the ta-storage capability of conventional cording, on magnetic tape, paper tape id punch cards, electron-beam cording provides a means of reproduc- g pictorial material electronically, with fidelity close to that of photography. However, it is still too early to tell iether electron-beam recording will st answer the demands of both indus- and government for higher recording nsities and greater bandwidths. Al- ady laser recording schemes are show- promise in information storage.

Electron-beam recording is any thod of storing information, tempor- ly or permanently, in which a beam cloud of electrons either modifies recording medium or prepares it for dification by another means, such as posure to light. A variety of record- schemes exist which incorporate ctron-beam recording techniques.

The basic device in an electron-beam ording system is the electron gun, in a cathode-ray tube and an electron croscope. The accelerating voltage is re like that of the cathode ray tube— m 5 to 25KV—rather than the 100- potentials of electron microscopes. e cathode or beam current may range m less than a nanoampere to a high one milliampere.

The resolution, or diameter of the ctron beam, depends on the type of ording system, and is usually be- en that of the electron microscope with a resolution of 0.05 micron and the CRT which has spot sizes of approximately 25 microns. Typical electron beam recorders have spot sizes between 2 and 25 microns.

The deflection of the electron beam may be done either electrostatically or electromagnetically. Some form of dynamic spot correction is usually necessary for wide-scan applications.

Though the electron guns in various systems differ, certain characteristics are common to most. Filaments are generally made from pure tungsten and in the configuration of a hairpin. The proper operating temperature is obtained with a filament current of 2 to 5 amperes. The filament life is limited and is related to the operating temperature and the quality of the vacuum. Despite this, life-times in excess of 100 hours are now possible.

In some applications completely sealed electron gun assemblies are used, and maintaining a good vacuum is no trouble. But some of the advantages of electron-beam recording can best be exploited with schemes that allow access to the vacuum chamber; this requires repeated evacuation.

As in most information-storage systems, some means of handling the recording medium must be available. Often this involves transports and drive mechanisms similar to those in tape and film-reeling devices. The importance of speed stability increases as higher frequencies are recorded. Magnetic-tape transport technology has provided answers to the stability problem.

In one electro magnetic recording, an electron beam scans a multigap recording head, energising each of the recording elements sequentially. Magnetic tape passing over the head is magnetised in accordance with the signal which modulates the electron beam.

In another method, electrons deposited on thermoplastic form a charge pattern, or latent image of the information. The material is heated and the charge pattern causes it to take on the appearance of a topographical map, with the surface ripples representative of the recorded information. (See article "A Thermoplastic Recording System" in "Radio Television and Hobbies," June, 1960, p. 23.)

Electron beams can also record information by depositing charges on a dielectric material, by exposing photographic film to form a latent image of the recorded data, and by machining thin films.

The use of photographic film for information recording is as old as the box camera, yet improvement continue to expand the capabilities of silver-halide film.

Electron-beam recording on silver-halide film has been the subject of analysis at the Eastman Kodak Co.'s research laboratory. Based on results there and elsewhere progress has been

---

ANTICIPATED BY EIDOPHOR

Although electron-beam recording was first reported in the late 1950s, some of its principles were anticipated by the Eidophor television projection system developed by Fritz Fischer of the Polytechnical Institute of Zurich, and others, in the 1940s.

In the Eidophor system, a modulated electron beam creates a charge pattern on a thin layer of special oil. The oil's surface is deformed in proportion to the charge density accumulated at any given point. The beam is velocity modulated to produce a charge pattern proportional to a video signal.

The electron gun in the Eidophor system has an accelerating potential of 15 to 20KV, a beam current less than 100uA and a spot size of 0.0005 x 0.004in.

The oil has the consistency of honey and is continually renewed by the slow rotation of a mirror and the wiping action of a knife edge. The charge pattern can be made to decay within the time of one TV frame by having the oil slightly conductive, allowing the pattern to be continually rewritten.

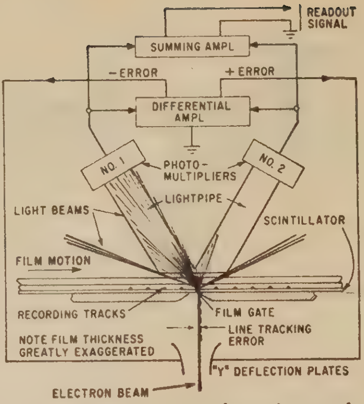
The Eidophor's optical system reflects light from the mirror and projects it onto a viewing screen. The light is modulated by the ripples on the oil.

If the information recorded as ripples on the oil were frozen, a permanent record — similar to a thermoplastic recording—would result. ■

made toward high-performance video and instrumentation recording.

Kodak's electron-sensitive film is called Direct Electron Recording film. Relatively insensitive to light, it has extremely fine grain, and may be reversed in developing to produce direct positive transparencies. Because an electron beam subjected to a 15KV acceleration attains several thousand times the energy of a photon in the visible portion of the spectrum, a substantially shorter exposure to electron bombardment will result in the same film density as with photon exposure.

Electron-beam recording on silver-halide film is similar in principle to other electron-beam-recording schemes. A focused electron beam is directed to the film by deflection plates or coils. Very little deflection capability is needed in the longitudinal direction, since film motion provides the major component of the longitudinal, or y scan. Normal sweep retrace may be used in the transverse or x direction, or the y plates may execute a short line jump at the end of each line allowing the beam to be scanned back across the film by the x plates. The information to be recorded intensity-modulates the beam so that the ra of electron incidence is directly propo tional to the recording signal. Howeve as with thermoplastic recording, oth modulation schemes may be used.



Silver halide recording is read out by collecting the light produced when the electron beam strikes the scintillator material on the recorded tracks. The readout beam is centred on the recorded track and light produced when the film is struck by electron beam in the facsimile scanner is transmitted to photomultiplier valve by light pipe.

The film, presently 16mm wide, co sists of a 0.003- to 0.004-inch polyest base called Estar and an emulsion several microns thickness. A very th conductive layer can be deposited belo or above the emulsion to allow the neg tive charges deposited by the electr beam to leak away from the area which further recording will take pla Without the conductive layer the fi could charge to some negative potenti causing beam displacement and defocu ing.

Following electron exposure, the cording merely consists of a late image, similar to that of a photon cording prior to developing. The expos film is removed from the recorder a processed much like ordinary pho graphic film. A transparency is produc in which suitably modulated raster lin have been laid down side by side, eith in the left-right fashion for instrument tion recording, or in the normal TV rast pattern. Since the raster lines are on order of 6 to 12 microns wide, the e cannot resolve them individually. T recording is therefore a very high res lution pictorial image.

Instead of pictorial information, modulation may merely correspond instrumentation data input and hen have no spatial coherence between ad cent lines. In either case the recordi frequency can be 100MHz or high with a signal-to-noise ratio of at le 30dB.

Silver-halide recordings are outstan ing where the need is for non-erasable permanent memories, such as in histo cal-document storage or stored progra and tables. Such storage is used in International Business Machine Corp large-scale computer memory syste being built for the Atomic Energy Co mission's Lawrence Radiation Labo tory in California. The basic stora elements are electron-sensitive silv halide film chips, 35mm x 70mm, co tained in small plastic cells. The cel each holding 32 film chips, will mechanically positioned in a writi station where an electron gun will expo the film with the required informati digitally encoded.

I.B.M.'s photochip system reads optically. A flying spot scanner, who light output is modulated by the inf mation recorded on the film chip, co verts the stored data to electronic fo by a photomultiplier tube.

New to the silver-halide electr beam-recording field is a television fi recorder being developed by Minnes Mining and Manufacturing Co. Te vision kinescope recording requires cathode-ray tube and camera-film co bination to record pictures with fi whereas Minnesota Mining's recor exposes electron-sensitive film dire with an electron beam. Advantages kinescope recording include eliminat of losses in the lens system, electron photon conversion losses and phosp and glass faceplate losses.

Ampex, GE, RCA and others ha demonstrated capability in recording electron-sensitive silver-halide fi ("Electronics," Vol. 39, No. 11.).

ANOTHER "FASE" IN MAN'S SUBJECTION TO MACHINES

The second word in the above title is not a miss-spelling but an acronym, standing for "Fundamentally Analyzable Simplified English." This new version of the language developed by Dr Lee E. McMahon, a psychologist working at Bell Telephone Laboratories, U.S.A., is a kind of Basic English for computers.

The idea is to eliminate the confusion which can occur in information retrieval systems based on computers about the relation of words in a sentence. Translation into FASE is a matter of rearranging the words in a sentence so that it can be easily parsed by a computer. The result, however, is indistinguishable from ordinary English — so that even though man is having to adapt his mode of communication to the needs of the machine at least he is not being made unduly aware of it! This can be confirmed from the following quotation from a Bell Labs information bulletin which is itself written entirely in FASE (making due allowances for American characteristics):—

"Dr McMahon has reduced the English language to a strict form in which syntax is clear and sentences are easily broken into component grammatical parts to avoid ambiguity. For example, 'Time flies' would be ambiguous to a computer because the roles of the noun and verb are interchangeable. In addition to its popular interpretation, this expression could well be an imperative statement demanding that we clock the little insects.

"However, a sentence in FASE strictly maintains the sequence of subject, verb and object; modifiers like adjectives and adverbs, and other parts of speech must fall into line. A complicated set of rules has been devised to ensure unambiguous syntax.

"Consider 'Time flies' again. A computer which reads FASE would interpret this correctly, since 'time' would be taken as a noun. To demand that someone clock the insects, we would have to rewrite the sentence. For example, we might say 'Determine the speed of flies.'

"In a FASIC operation, abstracts or documents would be written or rewritten in FASE. They would then be punched on cards, and stored in a computer. The computer might then be instructed at any time to index or to retrieve information by a special program based on FASE grammar. These documents can be indexed and retrieved on the basis of grammatical units and relations which are not useful in present systems because of the syntactic ambiguity of natural English.

"Dr McMahon estimates that a competent writer of English would need a few months to learn how to write FASE fluently.

"FASE also may provide a more accurate computer translation of foreign languages. Automatic translation of foreign scientific papers is growing into a big business; but the results are not always reliable. Although present mechanical translation is based on grammar to an extent, it involves complicated series of computer decision-making. To some degree, these necessary complications compensate for inherent ambiguities in the language being used. FASE, which removes the syntactic ambiguities in English, would simplify the task of the computer and lessen the chance of error."

Bell Labs point out, however, that while syntactic ambiguity has been eliminated in FASE, there are still problems arising from semantic ambiguity to be overcome. ("Wireless World," Vol. 72, No. 8.). ■

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CG-409

SEE NEXT PAGE FOR SPECIAL INTRODUCTORY OFFER.

COASTAL RADIO STATIONS TO HAVE "DREAM" RECEIVERS

New communications receivers of advanced design have been ordered by the Overseas Telecommunications Commission (Australia) for use in coastal radio stations. Made in U.K. by the Plessey company, the receivers were described recently, by the British journal "Electronics Weekly" (issue No. 294) as an operator's dream.

The Commission has ordered the receivers, known as the PR155, from the Plessey Electronics Group in Australia. The PR155, which was released only recently by Plessey, uses solid state circuitry and features precision tuning with high reset accuracy. It is suitable for all main communications modes of CW, AM and Single Side Band (upper and lower) over the frequency range 60KHz to 30.1MHz.

In its report, "Electronics Weekly" says:

Some 160 semi-conductors are used in a triple conversion design which follows extensive research into specific requirements of the major user organisations for a general-purpose receiver, and incorporates a number of features believed to be unique in a set of this class.

Initially two major versions — the standard PR155 and a PR155M, which will incorporate a frequency counter to allow precise pre-tuning to considerably better than 100Hz of any specified frequency to give instantaneous intelligibility on SSB—are to be marketed but a number of other versions are likely to be introduced later.

The three intermediate frequencies (37.3MHz, 10.7MHz and 100MHz) are all fixed and protected by selective filters, with a 37.3MHz crystal filter immediately following the first balanced four-diode mixer to overcome the well-known problems of cross-modulation and intermodulation of fully transistorised receivers.

Although the set follows the now accepted practice of splitting its coverage into a series of 1MHz "bands" with direct calibration, this has been achieved by means of a phase-locked oscillator controlled by a 1MHz crystal in conjunction with a stable 2.3-3.3MHz interpolating oscillator, and does not use any form of tunable or broadband IF techniques.

In effect, this represents a halfway house to the use of a full synthesiser, at a considerable saving in cost.

A further crystal filter is used in the 10.7MHz IF, but the main selectivity characteristics are shaped at 100KHz, using a 6KHz bandwidth LC filter for AM, 3KHz mechanical filter for SSB and 300Hz crystal filter for CW on the prototype models, but with space available for additional filters to cover users' requirements.

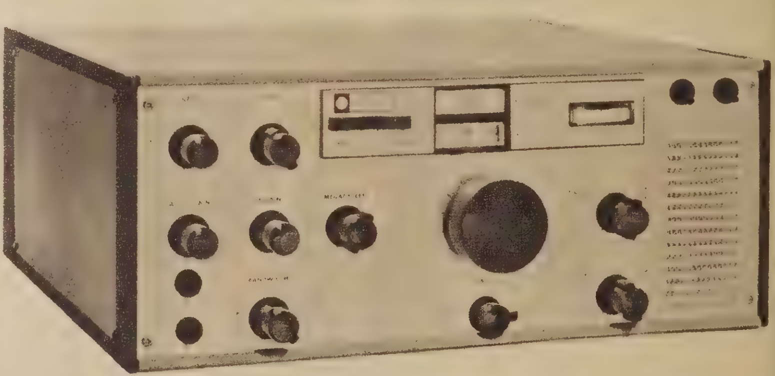
A 12KHz filter would be used for ISB. Similarly, modes other than DSB, SSB and CW could easily be built in.

Modular construction is used and the RF amplifier (one of the relatively few germanium transistors, over 80 per cent of the semi-conductors being silicon) uses sub-octave wideband filters but is protected by a local AGC system.

Noise factor is typically 9dB or better throughout the range. Frequency stability after initial warm-up is claimed as better than ±30Hz, or ±5Hz short term. Spurious radiation has been kept down to an extremely low figure.

The real test of any communications receiver, however, is less in the paper specifications than how it performs in practice under average conditions.

And it was with especial interest that the PR155 was tried out, over a period of several day, in a typical London suburban location, using a low dipole aerial.



The Plessey PR155 solid state receiver. It is suitable for all main communication bands over the frequency range 60KHz to 30.1MHz in 1MHz steps.

During this period, the set was used partly for long-distance CW communication on the 14MHz amateur band—with over 50 contacts from the Maldives and Kirghizstan to the west coasts of the U.S.A. and Canada—partly for general listening to amateur, commercial and broadcast stations from 56KHz up to 30MHz.

Extensive checks were also made on the marine bands on MF, IF and HF and on the general low power CW and SSB stations on many frequencies.

The outstanding feature of the receiver is undoubtedly the certainty with which stations can be tuned rapidly and held with minimum use of controls.

The set appears to overcome to a remarkable degree the ever-present semiconductor problem of front-end dynamic range, incorporating both the local RF amplifier AGC loop and an elaborate "hang" AGC with 10 millisec. rise time, 400mS hang and 50mS discharge, suitable for all modes.

The set is claimed to handle an RF input up to 6V without damage and certainly no problems were encountered in running it alongside a 100-150W transmitter which must have been leaking a powerful signal into the receiver input circuits.

The linear "film scale" is some 84in long on its 1200KHz span (1MHz plus a useful calibrated overlap of 100KHz at each end), giving 1/8in per KHz on all frequencies.

The set can be tuned rapidly by means of a flywheel knob at 60KHz per revolution and then precision tuned by the same knob at 8KHz per turn, giving ease of CW and SSB tuning and a reset accuracy of the order of 250Hz with the standard model.

Linearity and stability of the interpolation oscillator are achieved by the permeability tuning and temperature compensation and all tuning is obtained by moving one core in one coil—with complete elimination of ganged tuning capacitors.

An unusual feature is that the basic 1MHz oscillator is used to provide calibration marker pips at 100KHz, and in the production model will also be used in the sideband-selection conversions so that crystal tolerance problems will be eliminated.

No difficulty was experienced in receiving broadcast stations as SSB signals, giving immediate sideband selection.

It is, of course, many years since the noise performance of high-grade HF receivers imposed a limiting parameter, and today it is such questions as reset accuracy, stability on SSB, ease of SSB tuning, minimisation of image and spurious responses and internally generated spuriae, dynamic range and the absence of cross-modulation effects, the shape factor of the response curves and the mechanical ruggedness by which a receiver must be judged.

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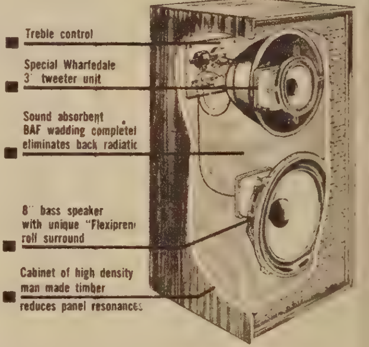
Which Compact Speaker System Offers Hig er Sensitivity And Effective L.F. Performance

The New Wharfedale "Linton"

Analytical appraisal of the development of miniature speaker systems reveals a compromise . . . the losses being in the lower registers and sensitivity. The new Wharfedale "Linton", although only 19" x 10" x 10", offers high fidelity sound reproduction with substantially linear bass response, excellent transient performance and high sensitivity due to the use by Wharfedale of large magnet assemblies. Two completely new Wharfedale units are featured in the "Linton" . . . an 8" bass speaker and a tweeter developed from the famous Wharfedale "Super 3". An entirely new roll- surround, Wharfedale Flexiprene, reduces the basic resonance of the woofer to only 43 c/s. Overall frequency response of the "Linton" is 40-15,000 c/s, power handling capacity 10 watts r.m.s. and impedance 8 or 15 ohms.

Styled by one of Britain's leading industrial designers, Robert Gutmann, the Wharfedale "Linton" cabinets are fabricated from low resonance man-made timber, finished in selected walnut or teak veneers. Lining is acoustic B.A.F. wadding to minimise cabinet resonances.

As world leaders in the field of sound reproduction, Wharfedale were reluctant to release a compact system until Wharfedale standards of sound were satisfied. Where smaller speaker systems are desirable, the new "Linton" offers fine performance standards designed to satisfy the most discriminating music lover. Listen to the new Wharfedale "Linton" today!


Treble control
Special Wharfedale 3" tweeter unit
Sound absorbent BAF wadding complete eliminates back radiati
8" bass speaker with unique "Flexipren roll surround
Cabinet of high density man made timber reduces panel resonances

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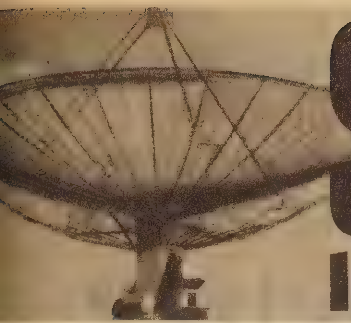


SCIENTIFIC AND INDUSTRIAL NEWS

;overnment Defence spending criticised

At the recent annual general meeting of Pye Pty. Ltd. in ydney, the company's managing director Mr Peter Threllfall ɔmmented on the small proportion of defence orders placed ith Australian companies.

He said he was particularly interested in a recently published ticle by the Minister for Air concerning deliveries of the acchi jet trainer, in view of defence orders placed with Pye bsidiary company Bendix-Tecnico Pty. Ltd., which included ie for navigational equipment for these aircraft.

In this article the Minister had said that expansionary essure in the R.A.A.F. was taxing pilot training facilities and at delivery of the Macchi into service should be "not a day ter than planned."

The Minister had said that the R.A.A.F. had voluntarily curred a cost penalty of $12 million by placing the order for e plane in Australia, but had made it sound that this was a vour offered "to help keep the Australian aviation industry ɔing."

Mr Threllfal then said: "It is sad to reflect that this dustry — together with other elements of national defence pport like the electronic industry — which served Australia so ell in World War II, has got to the point where it needs a inisterial favour in order to "keep going."

"The situation is even stranger when considered against the ckground of a constant growth in defence estimates con- ined in recent Federal Budgets. Looking at these figures, one ɔuld expect to find the defence support element of Australian dustry to be flourishing. However, if a means test was run day on industry you would find that those sections of it iich have preserved a capacity for defence support would, most without exception, qualify for a pension.

"These industries have been forced into semi-retirement pre- aturely because Australia's Defence Services have preferred to most of their shopping overseas.

"On the face of it, the $12 million penalty attaching to ıstralian production of the Macchi sounds a lot but, in fact, represents only 3.8 per cent of the total R.A.A.F. budget for 66-67 of $314 million. I wonder what percentage of this dget will be spent overseas on equipments which could quite ell be made in Australia.

"It is worth observing that time and cost penalties incurred w in reviving essential industries might well convert into a esaving bonus in the time of any emergency serious enough cut Australia off from overseas supplies. Australia cannot — short-term — be totally independent, but it can be much ore self-sufficient than it is at this moment.

"It is to be hoped that the Government will become in- easingly aware of the necessity to support local defence indus- es. It is only in this way that Australia will be able to tain and extend the technological skills necessary to build and intain the sophisticated equipment necessary in any modern fence program."

'rint quality monitor

A new optical print quality monitor developed by Interna- nal Computers and Tabulators Ltd., I.C.T. House, Putney, ondon, S.W. 15, measures quality of print to assess whether it s readable by character recognition machines.

The company says that as yet optical document reading ıchines have not become widely accepted as computer input vices, and that a possible reason for this has been the absence of a convenient way of measuring print quality to ensure that it can be read by machine. The new print quality monitor is said to be simple and flexible in operation and economically priced. It can measure paper whiteness and blemishes, and the dimensions, density and quality of print characters.

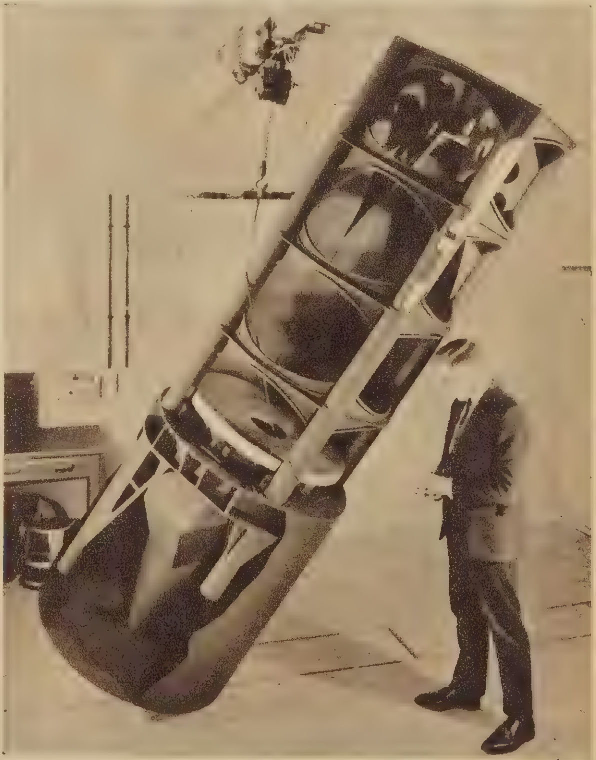
The monitor is effectively a miniature closed-circuit television system, with controls added to vary the discrimination level representing ink density. A scanning cathode-ray tube is used as light source. Its controlled light output if focused by a lens onto the document platform where a small window allows one character to be viewed at a time. The character is thus scanned by a spot of light just as in a reading machine.

The operator sets the required discrimination value of ink density by means of accurately calibrated manual controls. The light reflected from the sample character is detected by a photo-multiplier, which converts it into a video waveform. This is then compared with the reference level established by the operator and the resultant signal is used to re-form the character as a magnified image of the sample. The image appears as extreme light and dark areas on a second cathode-ray tube (the control panel screen) and is directly compared with the specified maximum and minimum character outlines engraved on a removable perspex graticule. One graticule is required for each character shape to be checked. Magnification is from 12.5 to 20 according to the size of character being assessed.

Dual reading micrometer

The "Anglometric" is the name of new micrometer — believed to be the first in the world with dual English/metric reading — designed by Shardlow Micrometers Limited of Sheffield, a member of the Guest Keen and Nettlefold group of Companies.

Commenting on the new micrometer, Mr P. F. D. Tennant, Director General of the British National Export Council, said "We welcome this development because the need now that we are going metric is for people to do their conversions on the spot



Pictured here is a full-scale model of Europe's first space telescope, designed by Britain's Atomic Energy Authority. The design for the telescope and its associated equipment has won a £3 million contract from the European Space Research Organisation. The completed telescope will be launched into space in 1971 in the Europa-I rocket, produced by the European Launcher Development Organisation (ELDO). The satellite will orbit the earth for one year, at a height of 400 miles, and will allow study of the spectra of the stars and galaxies.

OUR KEEN INTERESTS IN CIRCUITRY!

Why?

Circuits to us are important in determining the quality of any amplifier. Each set has many circuits. In our sets, some circuits provide that distinctive tone quality characteristic of all TRIO amplifiers.

Others, such as our new patented protection type circuit shown here, are designed to cut off the power switch to prevent transistors from being damaged by a short circuit or excessive power input. The power is automatically restored when the cause is eliminated.

Whatever the circuitry requirements, TRIO's accumulated technical abilities give an added assurance, that each and Every TRIO model is a masterpiece of internal craftsmanship. After all, for good results, we firmly believe, it's what is inside the amplifier, that really determines its overall operating capabilities and resulting tone qualities.

the sound approach to quality

TRIO

MW-MW-SW STEREO TUNER AMPLIFIER Model W-26

● OUTPUT POWER : 24 watts total music power (IHF Standard) ● FREQUENCY RESPONSE : 20-20,000 cps (±1db) ● SENSITIVITY : MW ; 10 microvolts 1,000 KC, SW ; 30 microvolts 17 MC (Input required for S/N 10db) ● INPUTS : MAG 1.5 mV, XTAL 20mV, AUX 100 mV (for rated output) ● SPECIAL CIRCUITS : Loudness Control, High Filter, Tape Monitor. ● DIMENSIONS : Width 17-11/16", Height 5-13/16", Depth 14".

SOLID STATE INTEGRATED STEREO AMPLIFIER Model TK-400E

● OUTPUT POWER : 80 watts total music power (IHF Standard) or 40 watts per channel. 32 watts RMS power per channel. ● DAMPING FACTOR : 20. ● FREQUENCY RESPONSE : 20-50,000 cps ±1 db. ● SWITCHES : Input selector, Mode selector, Low Filter, High Filter, Loudness, Speakers and Phones, Phase, Tape Monitor. ● DIMENSIONS : Width 15¼", Height 5¾", Depth 12¼"

Manufactured By **TRIO CORPORATION** 6-5, 1-chome, Shibuya, Shibuya-ku, Tokyo, Japan r the customer, instead of leaving it for the customer to do it imself."

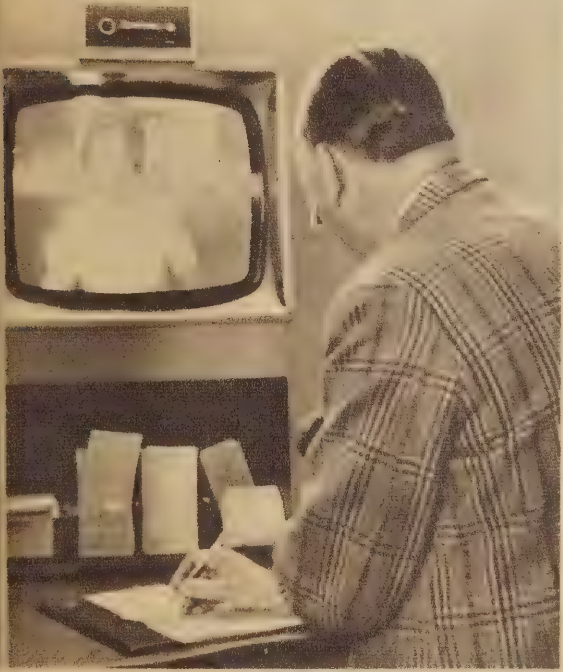
The new product will eliminate the need for duplicating easuring devices, make conversion tables unnecessary and cut ut hold ups while drawings are being converted.

Reading to within four ten thousandths of an inch or one undredth of a millimetre, the micrometer gives engineers simul-ineous access to the English and metric dimension.

huck with built-in adjustment

DMF Machinefabriek, of Postbus 17, Dinxperlo, the Nether-nds, has designed a chuck which, it is stated can be accurately djusted to 1/100mm in seconds by means of three built-in screws.

The chuck comprises a back plate, housing three jaws, the rews, a scroll and three conical pinions. The back plate has a tting surface which must fit exactly on to the shaft flange of the the. It fits by a collar provided with three cams on to the housing f the chuck. Bolt holes in the back plate are over 1mm larger than e fastening bolts so that is possible to alter the position of the ousing and thus adjust the chuck.



Designed to foil bank bandits, this closed-circuit TV system in a British bank allows the bank tellers to be located away from the public counters. Customers deposit money or cheques and other documents in a metal container, which is carried by compressed air tube to the teller, who is usually located on a floor above. Bank officials say that a person withdrawing money receives his cash within 25 seconds of placing a cheque in the container.

Once the fastening bolts have been loosened or tightened the orkpiece can be adjusted with the aid of a key, by means of the rews, which press against the cams of the back plate. The chuck an be supplied in diameters of 110, 140, 165, 200, 250 and 300mm nd with weights of 3, 5, 8, 10, 15, 25 and 40kg.

elgium buys self-tuning transmitters

Fully automatic self-tuning transmitters which will be motely controlled over land lines are to be installed by the elgian Posts and Telegraphs Department for its new communi-ations centre at Ruiselede. In announcing the order, the sup-liers, The Marconi Company Ltd., of Chelmsford, England, y that the 30KW units to be supplied are from the MST range high-frequency self-tuning transmitters for which the company as booked orders totalling more than £7 million since it was rst introduced just over two years ago. Orders have so far been eceived from 27 countries outside U.K.

In the Belgian installation, any one of 235,000 different equencies at 100Hz steps in the range 4 to 27.5MHz can be selected from the control station without manual intervention at the transmitters. In fact, no personnel will be required at the transmitters, other than for periodic servicing. The remote control equipment will make it possible to set up and operate the transmitters, change the mode of modulation, monitor transmitter conditions and supervise alarm circuits entirely from the control centre.

Simplicity of frequency changing has been made possible in these transmitters (Type H1200) through the use of frequency synthesis and wideband amplifiers, which require no tuning, up to the final stage, which is automatically tuned.

A new process for plastic film

A new process for the production of sheets or films of elastomers — rubber-like synthetic plastics — has been developed by the U.K.'s Atomic Energy Authority in an effort to eliminate pin-holing and bubbles.

Drying time of the sheet has also been greatly accelerated and is of the order of a few minutes compared with as much as two days for some natural rubber formulations and four days for the butyl rubbers.

The process is particularly suitable for the production of shaped items such as heavy-duty gauntlets needed in the chemical and other industries where workers' hands require protection. The required shape is dipped in a solution of the elastomer and the coated shape is then immersed in a solvent which will extract the fluid used to turn the elastomer from a solid into a liquid.

The extractor liquid is chosen so that it will not effect the rubber and it can be selected from among the alcohols and ketones, preferably methyl alcohol and acetone. It can be used for a long time and contain a large proportion of the medium before efficiency falls off. Solvent media for the rubber include heptane, benzene, toluene and petroleum naphtha among others.

More information on this process is available from Veedip Company Ltd. of Farnburn Avenue, Slough, Bucks, appointed as licensees by the AEA.

Computer language research

Important work concerned with special tasks in vital areas of the computer field is currently being carried out by three technical committees of the International Federation for Information Processing.

Technical Committee 1 on terminology is engaged on the monumental task of preparing several monolingual dictionaries of information processing terms. Each volume will contain definitions of some 1,500 concepts which are generally accepted by the international computer community. Alphabetical listing of terms combined with standardized serial numbers of the concepts to which the terms apply will, in effect, make each volume part of a multilingual dictionary, and will prove invaluable for identifying

Under inspection here before being dip soldered is a complete panel, known as a "platter" for use in one of the new English Electric Leo Marconi range of microelectronics computers. The British Post Office has ordered £3 million worth of these computers for its "Giro" system, a cheap and simple, but fast money transfer system, which provides current account banking facilities for the general public.

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4-Pole constant velocity (15 watt) Motor. Speed variation continues from 15 to 80 R.P.M. with Click stop at 16—33⅓—45—78 R.P.M. Wow & Flutter Maximum 0.2%; Rumble and Hum negligible. Turntable 12" x 8 lb. Unit: 15⅜" Long; 13¼" Wide; 5½" High.

GOLDRING LENCO

GL-70

The new Goldring Lenco GL70 Transcription unit is unique. It features an 8 lb. non-magnetic diecast turntable dynamically balanced with lapped steel centre spindle running in sintered bronze bush bearings. The on-off switch automatically disengages the idler wheel from the turntable underside, preventing "flats" developing and also operates a microlift mechanism for the pick-up arm, allowing precise selection of record track and manual lowering of pick-up head. The positive vertical drive system allows for continuously variable turntable speeds. Adjustable pick-up arm with detachable head shell.

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quipment terms in other languages. The first edition of the nglish language vocabulary has already been published.

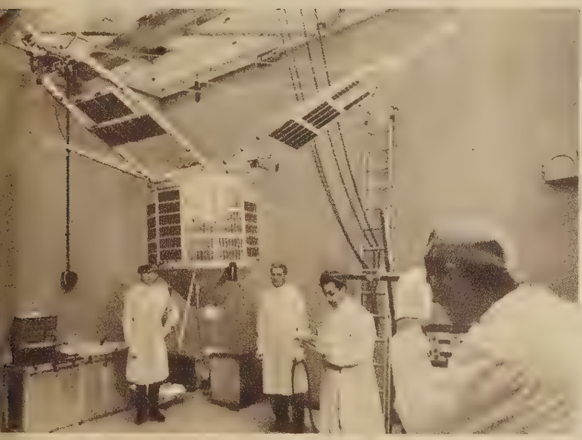
Technical Committee 2 is concerned with the development of ew international programming languages and the refinement of he existing ones. Considerable progress has been made on eveloping two new ALGOL-type languages, and on the refining of the existing ALGOL 60. The Committee is also considering he introduction of standards in programming languages, an rgent task which will help to eliminate the present day proliferaion of computer languages.

The long-term work of Technical Committee 3 on education s largely devoted to the preparation of programs for training nd technical education in the information sciences.

I.F.I.P. was formed in 1960 with the primary object f sponsoring international conferences and symposia on informaion processing to stimulate ideas in this field of science. At resent, 25 nations are represented in the Federation. The next .F.I.P. congress will be held in Edinburgh, Scotland, over the eriod August 5-10, 1968.

issile guided by television.

At the annual Farnborough Air Show this year, in the U.K., he Marconi Company showed some of the equipment which the ompany is making as its contribution to the MARTEL project, he Anglo-French air-to-ground missile which will use television look at the target area. Prototype models of one version of the evice are now nearing completion, says Marconi.



At one of the U.K. works of the British Aircraft Corporation, the first all-British satellite, U.K.3, which is due to be launched next year, is undergoing final testing. Here a weights engineer is testing the satellite for oscillations, aided by his team of test and development engineers. The gold plated wings and body of the satellite are studded with 7,400 solar cells. U.K.3 will be launched from Vandenberg, California, U.S.A., on an American Scout rocket and will circle the earth for one year, relaying back information relating to terrestrial noise, electron density in its vicinity, low frequency radio signals and distribution of oxygen in the atmosphere.

MARTEL allows bombing to be carried out without the unching aircraft having to come within visual or radar range f the target area. The TV system used in the device will allow e pilot to have direct visual identification of the target so that can steer the missile on its final course while the aircraft on its way back to its base.

The system uses an ultra-sensitive TV camera small enough fit into the nose of a missile, yet capable of giving a highuality picture for good target identification. The actual missile being developed by Hawker Siddeley Dynamics in conjunction ith Engins Matra of France.

uclear Research Foundation renamed

The Senate of the University of Sydney has approved the hange of the name of the Nuclear Research Foundation to cience Foundation for Physics within the University of Sydney. he new name had been proposed because the foundation's riginal name was no longer considered to be an apt description f its activities and scope.

The Vice-Chancellor and Principal of the University, Emeritus rofessor Sir Stephen Roberts, in announcing the change, said hat when the University Senate ratified the constitution of the uclear Research Foundation in 1953, the Commonwealth Government's future policy on nuclear science and engineering had not yet been formulated, and nuclear research in Australia was then only in its infancy, although it had already been realised that it was a very expansive field.

With the subsequent growth of nuclear research activity, and in an attempt to avoid duplication of research, the foundation had gradually directed its major activities towards work within the School of Physics' research departments. In the field of secondary education, the foundation had concentrated on annual Summer Science Schools. Because the name "Nuclear Research Foundation" tended to imply a limited or restricted field, not indicative of the activities now undertaken, the Senate had agreed to the change of name.

Stereo broadcasts in U.K.

In Britain, the B.B.C. is undertaking a substantial development in stereophonic broadcasts with the introduction of two or three stereophonic programs each day.

The B.B.C. has carried out extensive experiments in stereo broadcasting over the past eight years or so, but the new transmissions are on a bigger scale and designed for a wider public. Available at first only to listeners in south-east England, it is planned to extend the service area to the Midlands in approximately 12 months and to the north of England in approximately 15 months.

The transmission will be on the pilot-tone system, which has been extensively tested by the B.B.C., and is the established system for the stereophonic services in the United States, Germany, France, Italy, and Holland. The system is fully compatible, so that listeners with radios which are not equipped for stereo will hear the programs in the normal way. The emphasis will be mainly on music, including live broadcasts, some from the Promenade Concerts. A statement from the B.B.C. says that recent technical developments have made it possible to introduce a stereo service at a low cost, and further extensions of the service will be considered.

Colour TV decision

The French SECAM III colour television system was finally adopted by more than 30 countries, including France and the U.S.S.R., at the conclusion of the recent sessions of the Television Committee of the International Radio Consultative Committee in Oslo, Norway.

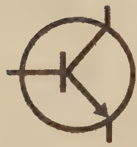
A French proposal that the SECAM IV system be adopted as the sole standard for the European broadcasting zone was seconded by the U.S.S.R. The proposal was rejected by the two main promoters of the rival PAL system, the U.K. and the German Federal Republic, on the grounds that they were too far advanced with the preparation of the PAL system, which would be used for the introduction of a colour television service in August, 1967.

A new map projection to "flatten" the earth and its oceans, designed by Lockheed California Co., of U.S.A., will help forecast ocean waves as we now do weather. Called the icosahedral-gnomic projection, it accurately converts the globe into 20 triangular map segments, some of which are seen on the wall in this picture. The globe's great circles are drawn as straight lines on the segments. A wave forecast based on a grid network overlaying the new map is made via computer. This information is then transferred to the more familiar globe, by a point-by-point system.

Since the adoption of the SECAM IV system, which is not yet fully developed, would involve delay, and therefore put the supporters of this system at a disadvantage, France and the U.S.S.R. formally confirmed their choice of the SECAM III system, which they will use for the introduction of a colour TV system in 1967. They also decided not to proceed with research on the SECAM IV system.

RIGHT

whichever way you look at it!



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AT313 Lo. noise r.f.	35	20	5	30	200	230	20	180	4	5.5	$80.00	$46.40
AT314 G.P. Audio	35	20	5	30	200	230	40	—	—	—	$72.50	$42.05
AT315 Conv. i.f. amp.	35	20	5	30	200	230	40	160	—	—	$75.00	$43.50
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DIVISION OF ELECTRONIC INDUSTRIES LIMITED

CIENTIFIC NEWS—cont.

Shown at the recent 1966 Television and Radio Show at Earls Court, London, was this Sinclair "Microvision," which the makers, Sinclair Radionics Ltd., of Cambridge, U.K., claim is the world's first complete pocket television set. It has a screen size of 2in and has overall dimensions of 4in x 2½in x 2in.

akes steel look like wood

Steel strip can be given the appearance f wood by a process patented by Societe ivile de Recherches et d'Etudes Indusielles, of Route de Bonne Nouvelle, euville-les-Dieppe, France.

The steel sheet is degreased, phosphated, nd coated with resin, which is cured. This followed by a further layer of polyester sin. To this base is then applied a wood eneer, or imitation veneer (a printed textile ore, for example). It is claimed that the aterial is suitable for furniture, boxes, ggage and decorative panels.

attery operated car jacks

Automobile jacks operated off the car's ectrical system are expected to make life asier for the motorist. The electrical jack a product of Acme Missile and Conruction Corporation, of 43 N. Village venue, Rockville Center, New York.

It is about the size of the normal car ck and has a long flex to plug into the r's cigarette lighter. A pushbutton through e jack controls its action: pushed one ay, the jack rises, pushed the other way lowers. When the pushbutton is in neutral e lift is locked into position.

igh-power TV transmitters

In U.K., the B.B.C. has ordered from e Marconi Company three 40KW UHF elevision transmitters with the very high utput power of 40KW. Designed to a B.C. specification, to broadcast programs r the new B.B.C.-2 service (including olour, which is due to begin in U.K. ext year) the transmitters will be suitble for completely unattended operation.

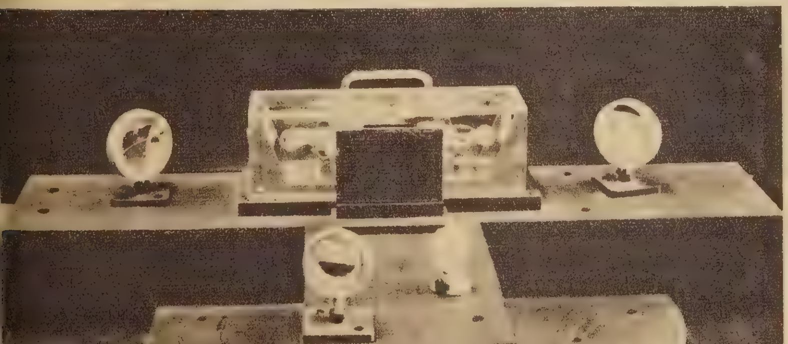
The very high output power is generatd by a single four-cavity klystron made by nglish Electric Company. Marconi say at 40KW is the highest power yet proosed for such a device operating at teleision frequencies.

luidic devices

Two new multiple-input fluidic devices r machine control have been developed U.S.A. by Corning's Fluidic Products epartment. The devices, comprising a our-input flip-flop and a four input NOR gate, have been designed to provide more logic flexibility with fewer components at a lower cost.

Operating on the wall attachment principle, both are load insensitive and can fan out to four similar devices. Frequency response is more than 1,000Hz. Power nozzle pressure is 3psi nominal, 20psi maximum and 1.5psi minimum. Switch pressure requirement is 5 to 15 per cent of the supply pressure, and pressure recovery is 33 per cent of supply pressure maximum. Each can be used as a logic element in systems designed for switching, amplification, counting and pulse shaping.

The new products become part of a range of almost two dozen complementary standard devices now available. The range can be used for logic and control functions as well as for breadboarding more complex systems. ■



A series of experiments on holography are currently being conducted at the University of N.S.W. by Elmar Laisk, author of the holography article in "ELECTRONICS Australia" for August 1966. Several holograms from the University of Michigan have already been displayed and the above photograph shows Mr Laisk's set-up for making holograms. The large glass case contains the laser, which emits light from both ends. The mirror on the left is concave and, in conjunction with the flat mirror at left foreground, provides the reference beam. The mirror on the right is also concave, and illuminates the object (right foreground). Both light beams are recorded on the photographic plate in front of the laser case. The whole assembly is supported by a 5 cwt. steel base.

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Logic and counting circuits — 6

A survey of READOUT DEVICES

Introduction — direct inclusion of lamps in the circuit — driver amplifiers — "columnar" vs. "in-line" display — the edge-lit numeral display unit — projection-type units — cathode-ray indicators — miniature neon tubes — numerical neon indicators—the Mullard "Digitube"—the decade trigger indicator — the electroluminescent display panel — the moving-coil numerical indicator.

by Jamieson Rowe

As we have seen in earlier articles in this series, digital circuitry deals with numerical information. It uses pairs of magnitude and/or polarity values of electrical voltages or currents to represent the numerical information statements, according to arbitrary "logic conventions." And it effectively performs mathematical and logical operations on the information by performing analogous electrical operations on their representations.

Although digital circuitry thus deals with information very effectively as electrical signals, it is not normally the case that human beings can handle the information conveniently or efficiently in the same form. We humans usually feel more confident and work somewhat more effectively with the information presented in the form of printed figures, glowing numerals, indicating pointers, and the like.

In view of this, it becomes essential to provide digital equipment with information **transformation** facilities both at its "input" and at its "output." By means of these facilities the incoming information may be transformed into an electrical representation at the input, and the outgoing information at the output transformed back into a form permitting convenient interpretation by the human user. Input-output transformation is thus an important function in digital equipment.

For convenience in the present series of articles, the general topic of input-output transformation will be split into three aspects. The first of these concerns readout devices, which are the subject of the present article. The second concerns binary- and BCD-decimal decoding and analogue conversion, which is the subject of the following article. And the third aspect concerns input pulse generators and shapers, to be discussed in a later article.

It is not proposed to discuss in the present articles the devices or techniques of the type employed in data-processing applications, such as punched-card and punched-tape equipment or high-speed printers. These may be treated at a later date; for the present we will be concerned mainly with devices and techniques associated with digital measuring instruments. And in particular, with readout devices employed in displaying the count contained in transistorised or integrated circuitry.

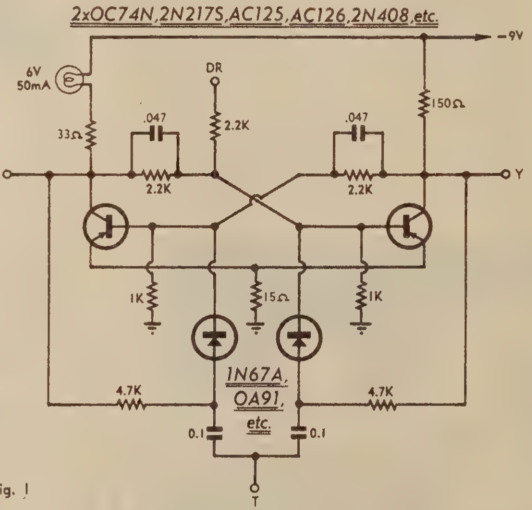


Fig. !

GATED R-S FLIP-FLOP WITH INDICATING LAMP

To begin, then, probably the simplest way of performing readout with transistorised counting circuitry is to fit low-power incandescent lamps directly in series with the appropriate collector leads. Thus a counting register may use flip-flops of the type shown in figure 1 to give a direct readout of its registration via the 6V 50mA lamps.

However, while simple and economical, this technique has rather serious shortcomings. Perhaps the most obviou
ot these is that the information reado
must be made in the coding system act
ally used by the counting circuitry. U
less the circuitry actually counts
decimal, the operator is thus faced wi
learning to read either pure binary
one of the many BCD codes, or perha
the bi-quinary or qui-binary code.

From the technical viewpoint, the
is the shortcoming that the inclusion
lamps directly into the counting circuit
severely limits the high-frequency pe
formance. In order to operate the lam
directly, the circuitry must general
operate at fairly high current levels; n
only this, but the lamps themselves pr
vide a somewhat inappropriate load in
pedance. Both factors tend to redu
the maximum attainable counting spee

In short, while direct inclusion of lo
power incandescent lamps into t
counting circuitry is simple and econ
mical, it is really only suitable for rea
out of circuitry which is counting
low speeds and in a decimal fashion.

Thus the circuit of figure 1, wh
quite practical, is really only suita
for use in circuitry of the "normal ri
counter" variety, at speeds up to abo
10KHz. Additionally, it could be us
for demonstration of binary and BC
counting on an experimental basis.

A development from the simple lan
technique overcomes both major disa
vantages of the latter by providing ea
lamp with its own "driver" amplifi
an example of which is shown in figu
2. The use of driver amplifiers both
duces the loading effect of the lam
upon the counting circuitry and a
permits the use of higher-power lam
for convenient readout.

No less important, it also allows t
readout lamps to give an indication
a code other than actually used by t
counting circuitry, by permitting the
terposition of decoding circuitry betwe
the counting register and the lan
drivers. (Decoding and conversion c
cuitry will be discussed in the next a
icle in the series.)

The circuit configuraton shown is th
of a simple non-inverting driver suita
for operation of 12V lamps up
150mA. It is designed for use wi

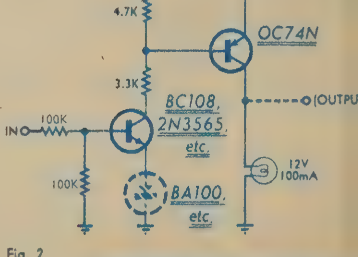


Fig. 2

LV INCANDESCENT LAMP DRIVER

unting circuitry operating from a 9V supply, for example the flip-flop cuitry discussed in the preceding arte. As may be seen, it employs a mplementary NPN silicon and PNP rmanium transistor pair in cascade, ing a current amplification of about 00. The transistors used are very v cost types and are easily obtained. The "fan-in" or effective loading effect quite low—approximately 90uA. The np voltage may be used as output further logic if desired. The silicon de shown dashed in series with the PN emitter is to provide additional toff bias where the input "0" level y tend to rise above earth potential. is mainly necessary when the driver used with decoding circuitry.

Note that while this circuit performs DC amplification, it is designed solely for digital "on-off" use. It is not suitable for linear amplification.

Normally, if such lamp drivers are ployed they would be used in conction with decoding circuitry to give cimal readout. Thus in the typical se, each counting decade would have associated decoding circuit together th a set of 10 driver circuits and 10 nps signifying the numerals 0-9.

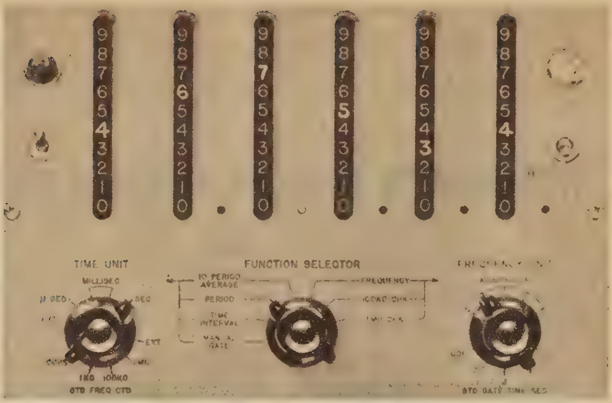
The simplest way of using the 10 nps for display is to arrange them in vertical column. They may be mount- either in simple fashion with suitle panel lettering, or alternatively unted behind transparent numeral gravings so that each lamp illuminates appropriate numeral.

A "columnar" display of this type is ite practical and in fact was used in number of early digital instruments. strated is an early "Hewlett-Packard" ctronic counter, which used the transrent-numeral columnar system. (The unter concerned actually used valve cuitry and neon lamps, but the pice illustrates well this type of display.)

The disadvantage with a display of s type is that readout tends to be w and tiresome as a result of the gged" nature of the display. Rapid d convenient readout is difficult, as ch digit may occupy any one of 10 tical positions.

From the operator's point of view, the "ideal" display is one wherein the numerals for each digit always appear in the same position, so that the complete registration may be read conventionally as a contiguous horizontal number. For more practical readout systems it is thus desirable to produce such an "in-line" display.

Two main techniques have been deoped to permit an in-line display en using the 10-lamp readout system. One system uses the lamps to edge-ht small sheets of clear plastic, upon ich the numerals are engraved in all dots so that, when a lamp lights,



The "columnar" type of numeral display, as used on early digital instruments. (Courtesy Hewlett-Packard Co.).

the engraved numeral appears to glow. The sheets are stacked one behind the other behind a viewing window, the dot-structure of each engraving permitting even the rearmost numerals to be seen relatively easily when illuminated.

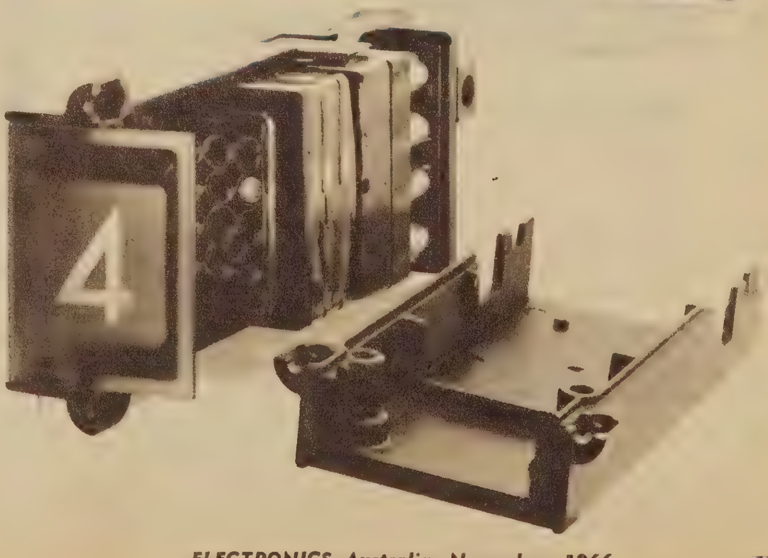
A readout unit employing this method is pictured. It employs a total of 11 plastic sheets, with the appropriate miniature 12V 100mA lamps fitted alternately above and below the stack and wired to small printed-wiring boards. It measures approximately 2½in x ⅞in x 1¼in and provides compact display of the numerals 0-9 together with a decimal point.

The alternative 10-lamp in-line display system uses the lamps to directly illuminate microfilm numeral transparencies, which are then projected optically on to a small round-glass screen. As direct lighting is rather more efficient than edge-lighting, this method gives a somewhat brighter display; however, the price tends to be considerably higher because of the precision optical components required.

A sample projection-type unit is pictured, with one side cover removed to show the internal construction. The unit has twelve 12V 150mA lamps, which mount in a removable common carrier at the rear. Between the lamps and the ground-glass screen are twelve optical systems, each consisting of a microfilm numeral transparency and the necessary condensing and objective lenses. The unit provides display of the numerals 0-9, together with polarity symbols "+" and "—."

While the low-voltage readout devices and systems discussed thus far are quite practical, and have been and still are used in many digital applications, they

A typical indicator of the edge - lighting type, the Koten RK-E1 by Okaya Musen Co. (Courtesy Craftsman Glass Pty. Ltd).



The projection-type "One-Plane Readout" by Industrial Electronic Engineers, Inc. (Courtesy Craftsman Glass Pty. Ltd.)

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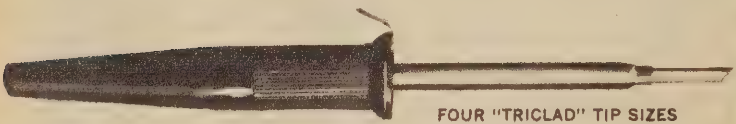

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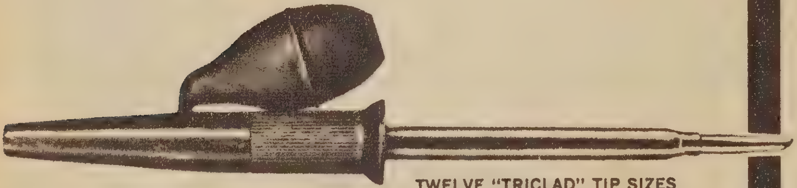

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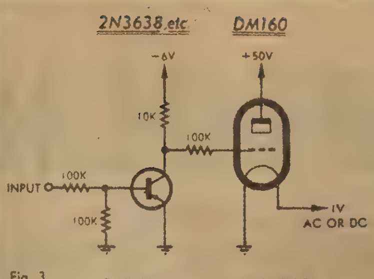


Fig. 3 CATHODE-RAY INDICATOR

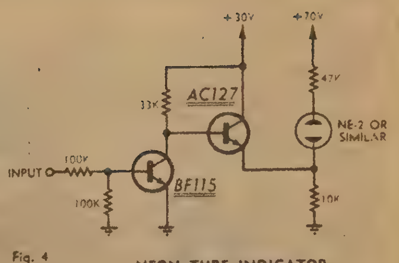


Fig. 4 NEON TUBE INDICATOR

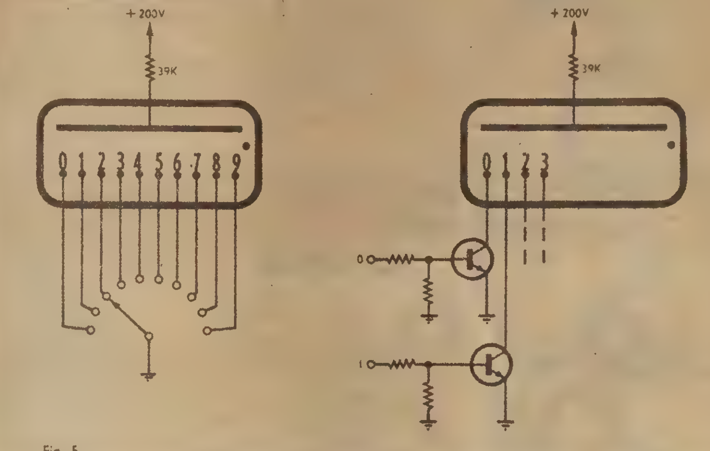
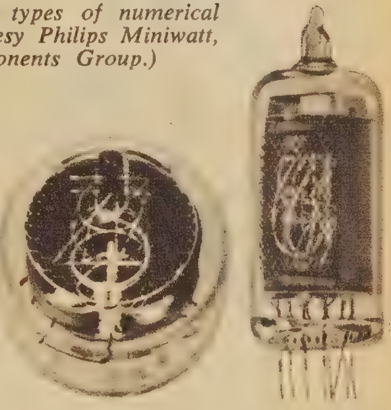


Fig. 5 NUMERICAL NEON INDICATOR



Examples of the two types of numerical neon indicator. (Courtesy Philips Miniwatt, Plessey Components Group.)

e by no means the only devices or stems in use. Many other devices ive been developed, some of which are aimed to offer the advantage of ighter and clearer display, while hers claim advantages in terms of ower supply economy, drive circuit nplicity, reliability, and so on.

Small **cathode-ray indicator tubes** of e miniature "magic eye" variety have en used at various times, both for nary and columnar decimal display. hese produce quite a useful display r a low power dissipation, and have a ery high input impedance. An exnple is the Mullard DM160, which oduces a bright rectangular glow when erating from supply voltages as low +50V. The directly heated cathode quires 30mA at 1V, AC or DC.

A typical circuit configuration used ith this type of indicator is shown in ure 3.

Here the negative logic convention is ed, with 0=0V, 1=−6V. In the abnce of input voltage, the silicon PNP ansistor is cut off; this connects the id of the tube to −6V via an effective 0K series resistor, cutting it off also.

To produce an indication, logical 1 ust be applied to the input. This drives e transistor to saturation, removing e negative bias from the tube and peritting it to conduct. Removing the put voltage reverses this mechanism, tting off both transistor and tube as fore.

Although quite practical, the cathodey indicator is not often used nowaays. Because it relies upon a therionic cathode it requires an additional ower supply compared with alternative evices; apart from this, the useful life nds to be comparatively short. These ctors combine with a moderately high osts to make it relatively unattractive mpared with alternative devices.

Perhaps the most widely used group f display devices are based on the coldathode discharge tube in one form or nother.

The simplest such device is the **iniature neon tube,** which like the mple incandescent lamp and the cathde-ray indicator, is a "single-bit" display evice and may be used for binary and olumnar decimal display. Figure 4 ows one possible way in which such tube may be used with transistor rcuitry.

Here a BF115 silicon NPN transistor used as an input amplifier and inverr, followed by an AC127 germanium PN as an emitter follower. The neon be is an NE-2 or similar, with a strikg voltage around 65V and a maintaing voltage of approximately 50V. The rcuit operates as follows.

With a logical 0 (=0V) applied to e input, the first transistor is cut off. s collector thus approaches +30V, arrying with it the base of the second ansistor. The latter, therefore, conucts and applies a similar voltage cross the 10K resistor in series with the eon tube.

Because the other side of the tube onnects to a +70V supply, this reuces the total effective tube voltage to nly (70−30)=40V, which is insufficient o cause the tube to ignite. Thus logial 0 results in the tube remaining dark.

If on the other hand logical 1 = +9V) is applied to the input of the ircuit, the first transistor conducts to aturation. This means that the collecor voltage drops to almost zero, carrying with it the base of the second transistor.

The second transistor is thereupon cut off, removing the +30V from the 10K resistor. And with the voltage removed from the resistor, the neon tube receives the full +70V supply voltage. It therefore ignites to give the desired indication.

While giving a fairly bright indication for a modest power consumption, the simple neon tube indicator suffers from the same disadvantage as did the incandescent lamp used in the circuit of figure 2, in that alone it is really only suitable for the columnar type of decimal display.

Here edge-lighting and projection techniques for producing numeral display are hardly feasible in view of the modest light output available.

As some readers may be aware, however, there is a development from the simple neon tube which was produced specifically for numeral display. This is the **numerical neon indicator tube,** marketed under such trade names as "Nixie" (Burroughs Corp.), "Digitron" (Ericsson Telephones Ltd.) and "Numicator" (Hivac Ltd.). Currently such tubes are the most commonly used of all digital readout devices, by virtue of their bright, easily interpreted display, their high efficiency and excellent reliability.

There are two basic variants of the numerical indicator tube, and the construction of both may be seen from the photographs. In one the numerals are viewed through the side of the tube envelope; in the other they are viewed through the end. Each method of construction has certain advantages with regard to numeral size, suitability for close mounting of tubes, and so on, giving the two somewhat different areas of application.

In both cases the tube is basically a multi-cathode neon tube in which the cathodes are either formed from wire or stamped from thin metal sheet in the shape of the desired numerals or mathematical symbols. The common anode is a fine wire gauze or perforated sheet through which the cathodes may be observed.

When a selected cathode is made negative with respect to the anode by about 180VDC, it glows with the familiar pink neon aura. The aura extends around the shaped cathode to a sufficient extent to permit easy observation even when the selected cathode is rearmost in the array. The unwanted cathodes are either left "floating" electrically or are clamped at a voltage above that of the maintaining voltage of the active cathode — e.g., at 100VDC negative with respect to the anode.

Figure 5 shows two typical ways of driving such tubes. Electrically, the

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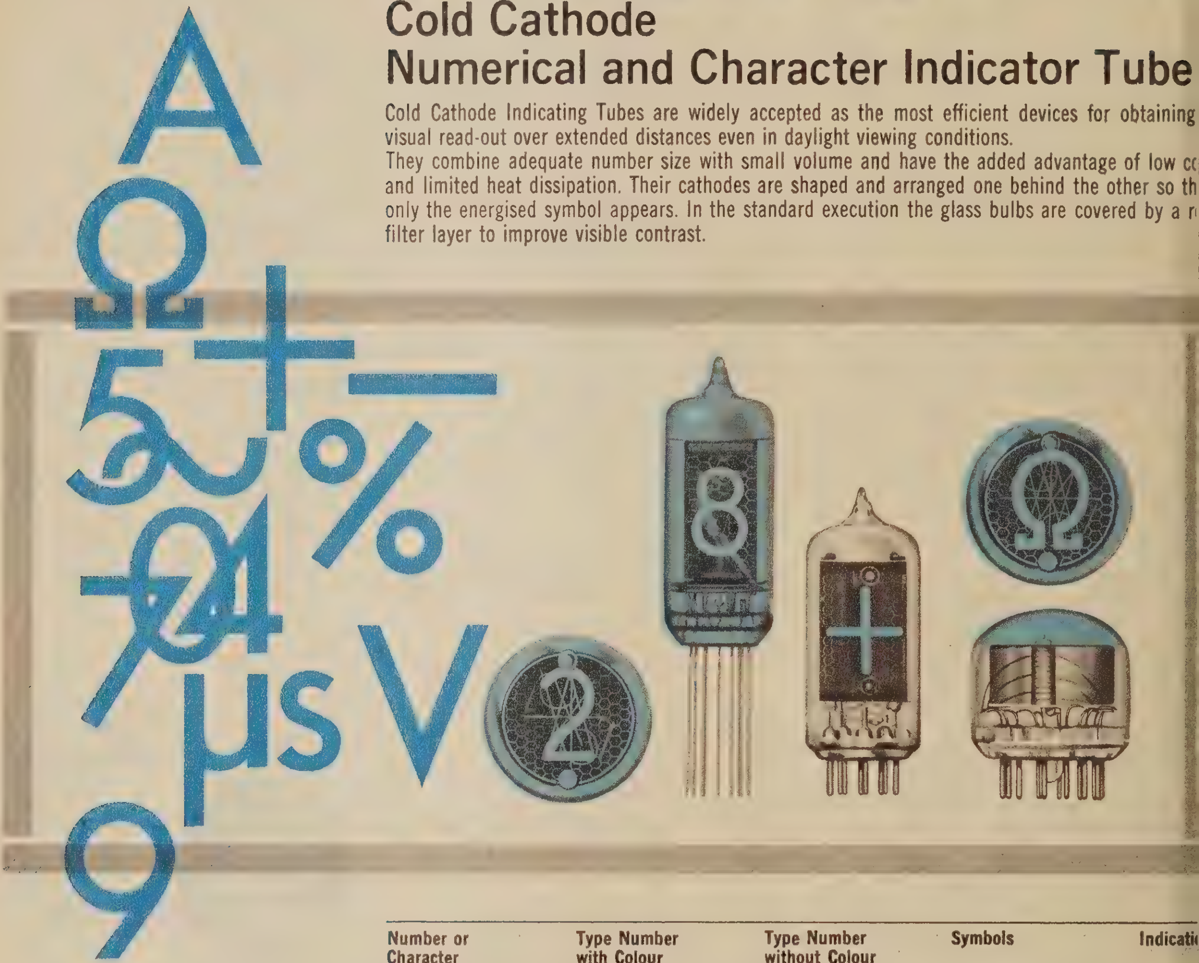
Cold Cathode Numerical and Character Indicator Tube

Cold Cathode Indicating Tubes are widely accepted as the most efficient devices for obtaining visual read-out over extended distances even in daylight viewing conditions.
They combine adequate number size with small volume and have the added advantage of low c and limited heat dissipation. Their cathodes are shaped and arranged one behind the other so th only the energised symbol appears. In the standard execution the glass bulbs are covered by a r filter layer to improve visible contrast.



Number or Character Height (mm)	Type Number with Colour Filter	Type Number without Colour Filter	Symbols	Indicati
31	ZM1040	ZM1042	0123456789	side o
20	ZM1041	ZM1043	+ —	side o
15	ZM1020	ZM1022	0123456789	end or
15	ZM1021	ZM1023	+ — ~ AV Ω %	end or
15	ZM1024	ZM1025	s ms μs ns c/s Kc/s Mc/s	end or
15	ZM1030	ZM1032	0123456789	side o
13	ZM1031	ZM1033	+ —	side o
13	ZM1080	ZM1082	0123456789	side o
8	ZM1081	ZM1083	+ — ~	side o
3	ZM1050		0123456789	end or
15	Z524M		BG12345678	end or

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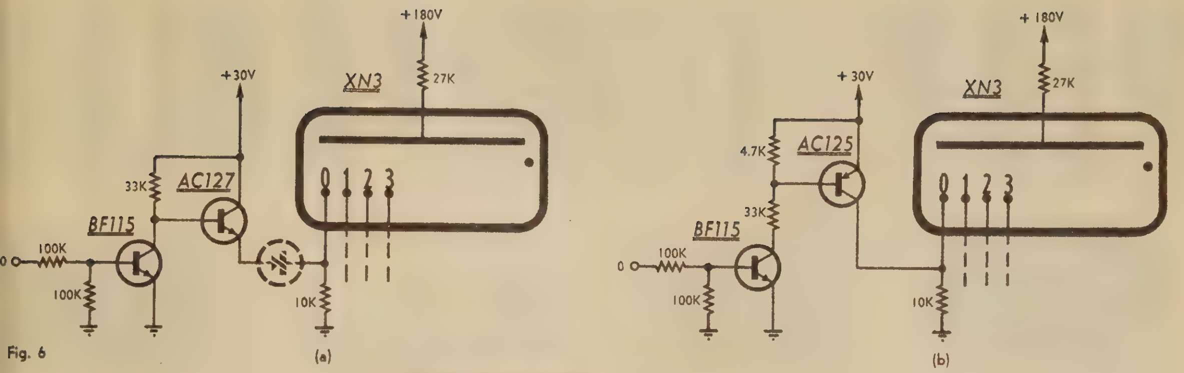


Fig. 6

nplest method of all is that shown at
left, using a rotary switch to connect
desired cathode to the negative line.
wever, such a system does not usually
d itself to convenient operation from
ctronic counting circuitry.

A more convenient method is to use
nsistors as switches between each
hode and negative, as shown on the
ht of figure 5. Here indication of the
ired numeral is achieved simply by
plying a suitable bias to the base of
appropriate transistor, to turn it
."

The disadvantage of the latter type
circuit is that it requires the use of
rly costly high-voltage silicon tran-
tors. Silicon transistors are required
ause it is essential that the switches
ve a low leakage when intended to be
f"—otherwise other numerals will
w along with that selected. And tran-
ors with a high BVceo voltage rating
required, because in operation the
selected cathodes "float" at a potential
ich in some cases becomes an appreci-
e proportion of the anode potential.
Vceo is the collector-emitter break-
wn voltage with zero base current.)

The circuit configuration of figure 4
be adapted to obviate this problem,
allowing the tube to be driven using
nomical lower voltage transistors.
is is illustrated in figure 6(a).

Here as before a pair of transistors is
anged so that in the absence of input
tage (or strictly, with logical 0 input)
+30V cutoff bias is applied across a
istor in series with the tube cathode.
ernatively when a logical 1 is applied
the appropriate input, the transistors
urate and cutoff respectively, remov-
the bias from the cathode and allow-
it to take the discharge.

The diodes shown dashed in series with
AC127 emitters are only required if the tube is operated at current levels sufficient to produce a voltage across the cathode resistors in the "on" state of greater than (30V + BVebo), where **BVebo** is the reverse breakdown voltage of the AC127 base-emitter junction. In such (rare) cases the diodes prevent possible transistor damage. With the economy XN3 tube and the circuit values shown, the diodes are not required.

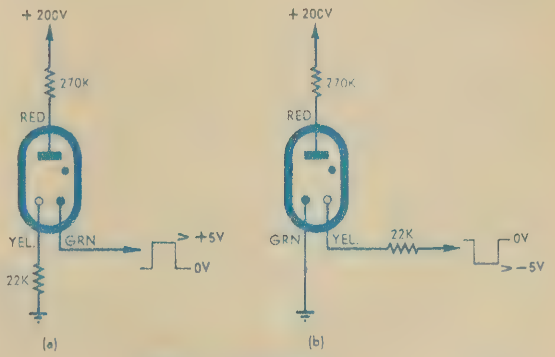
Where inverting or negative logic drive is required, the circuit configuration of figure 6(b) may be used. This is very similar to that just discussed, except that the second transistor is an AC125 or similar PNP type used as a common-emitter amplifier. Here the logic convention is the opposite to that of the other circuit, with logical 0 = +9V and 1 = 0V. To make a given cathode glow, the appropriate input terminal is grounded.

Drive circuitry for numerical indicator tubes need not necessarily be transistorised—although the major proportion of such circuitry is, in fact, of this type, because of the compatibility with transistorised and integrated counting/logic circuitry. Alternative switching devices include thermionic valves, three and four-element neon trigger tubes, thyristors or "SCR's," and other controlled semiconductor switches. Numerical indicator tubes may also be used to display the registration of cold-cathode counting tubes and vacuum trochotrons.

The simple neon tube and the numerical indicator tube are discharge tubes which are not in themselves particularly suited for the small drive voltages available from semiconductor counting or logic circuitry. Thus their use entails the employment of somewhat elaborate drive circuitry.

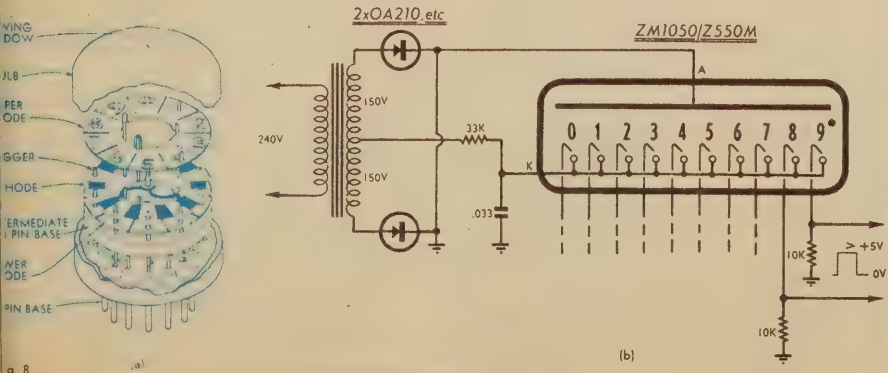
There are, however, cold-cathode display tubes which have been designed specifically for use with low-voltage semiconductor circuitry. Two such devices will now be discussed.

The **"Digitube"** (Mullard Ltd.) is a development from the simple neon indi-



TG121A "DIGITUBE"

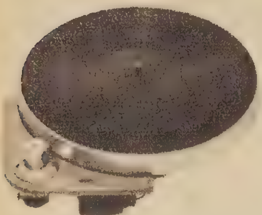
Fig. 7



g 8

NUMERICAL TRIGGER INDICATOR

PEAK TURNTABLES



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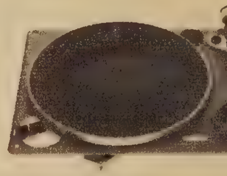

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ıtor tube, which it closely resembles. he difference between the two is that stead of a single cathode the Digitube ıs two—one of which is obscured be-nd a mask.

The geometry of the tube construction such that if both cathodes are at the me potential with respect to the anode, e **obscured** cathode virtually captures e total discharge. Under these condi-ons, the visible cathode remains dark, ving the "0" indication.

To produce a visible glow for indica-on of "1", the discharge is transferred the visible cathode simply by making is electrode a few volts negative with spect to the obscured cathode. As own in figure 7, this may be achieved feeding either a positive signal to the scured cathode (green wire) or a nega-e signal to the visible cathode (yellow ire).

In either case the drive signal re-ired is but a few volts, and is easily pplied by most transistorised circuitry. e loading is almost negligible, making very simple drive circuitry. And on e removal of the drive signal, the tube scharge returns automatically to the scured cathode, providing the tube-cur-nt is maintained within specified limits.

Fairly obviously, the Digitube is a ngle-bit display device with applications nilar to those of the incandescent lamp d simple neon tube. However, the cond low-voltage-drive discharge tube be discussed is a numerical indicator -although not of the "in-line" variety. is is a development of the neon trigger be which may for convenience be lled the **"Decade Trigger Indicator."**

An indicator tube of this type is the ullard - Amperex ZM1050 / Z550M, hose construction may be seen from e photograph and from the diagram of ure 8(a).

The tube is an end-viewing device hav-g 10 sector cathodes connected together a metal ring, with ring-shaped anodes th above and below. The anode ring arest the viewing window is provided th numeral cutouts, while each cath-e sector has a hole through which otrudes a small trigger electrode. All trigger electrodes are brought out parately, together with the common ode and cathode leads.

As may be seen from the circuit dia-am of figure 8(b) the tube is operated m a power supply employing a full ve rectifier—but essentially **lacking tering.** The tube anode is earthed, th the supply negative and the cathode ating. All trigger electrodes are taken earth via suitable resistors, across ich the drive signals are applied.

Operation is as follows: Because of unfiltered supply, the potential at the e cathode drops to zero periodically twice the mains supply frequency ., 100Hz). Each time this occurs tube must necessarily extinguish. ring each mains half-cycle, the cath-e potential rises (negatively) and falls oidally.

As the cathode potential becomes re and more negative the potential oss the tube approaches the ignition int. And it is with a trigger electrode t the discharge will first occur, be-se these electrodes are physically rer the cathode than is the anode.

It should be fairly obvious that if any of the trigger electrodes is made htly positive with respect to the rest, will be with **this** electrode that the dis-rge will occur. And the construction the tube is such that, if the ionisation produced by this initial discharge is sufficient, the main anode takes over the discharge almost immediately.

Numerical neon tube display is probably the most often used in modern digital instruments, offering bright, easily-read display at a modest power consumption. Illustrated is a modern digital voltmeter by Hewlett-Packard. (Courtesy Sample Electronics (N.S.W.) Pty. Ltd).

Providing the current levels are kept within a certain range, this produces a cathode aura confined to the associated cathode sector, and visible through one of the numeral cutouts in the front anode ring. Thus the tube displays the numeral concerned.

The tube can thus be arranged to display any of the 10 numerals simply by applying a small positive voltage to the appropriate trigger electrode. And as the discharge extinguishes at the end of every mains half-cycle, the display may be changed simply by removing the drive voltage from one trigger electrode and applying it to another. The tube is thus eminently suitable for use with low-voltage semiconductor circuitry.

It may be noted in passing that with suitably designed circuitry the decade trigger indicator may also be used as a counter and scaler. Used in this fashion it will operate at speeds up to about 1000Hz.

To conclude this brief survey of digital readout devices and techniques mention should be made of two types of device which are currently encountered rather less frequently than the types so far discussed. The first of those is the **electroluminescent display panel,** a relatively recent development which may well become very popular in the future.

As the name suggests, the operation of the device depends upon "electroluminescence," the phenomenon whereby certain compounds called **phosphors** emit visible light when subjected to an electric field.

An electroluminescent panel is basically a capacitor in which a phosphor powder is supported within a plastic or ceramic dielectric which is sandwiched between transparent conductive electrodes. An alternating voltage of about 200V RMS at 400Hz is applied between the two electrodes, producing a corresponding electric field in the dielectric and phosphor. The resulting glow is viewed through one of the transparent electrodes.

For digital readout purposes panels are arranged to have a number of electrically isolated segments, as in figure 9. Then by applying voltage across

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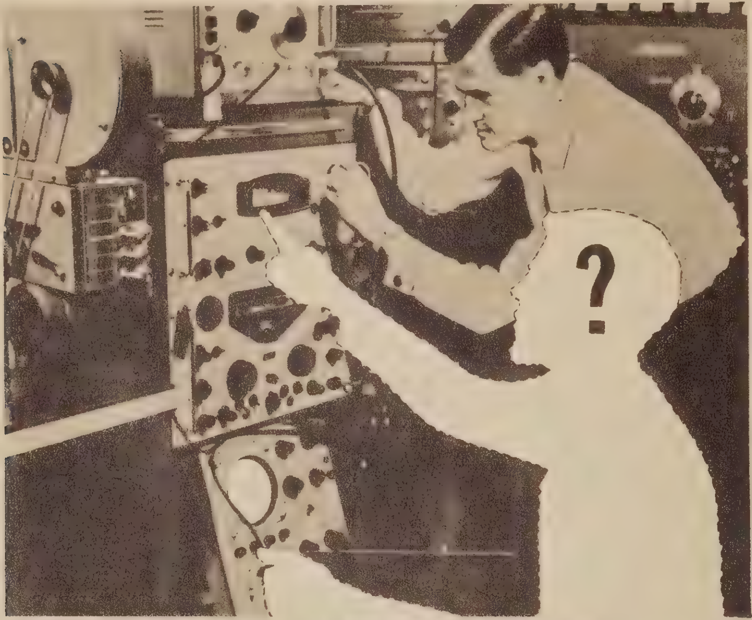

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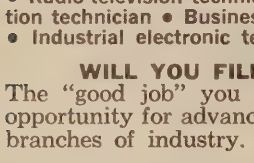

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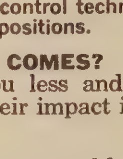

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various combinations of the segmen the panel may be made to display r resentations of numerals, alphabeti figures, or mathematical symbols.

Electroluminescent readout panels electrically efficient, take up little sp and may be inspected through a w viewing angle as a result of the effect "area source" of light. In addition th promise to have extremely high reliab ty, in view of the lack of heated fi ments and vacuum or gas filling.

Drive circuitry tends to be somewh more complex than with other reado devices, as apart from the usual bin or BCD-to-decimal decoding the c cuitry must also perform **"translatio** to ensure that the appropriate panel s ments are energised for each nume displayed. However, panels have recen been developed which perform "int nal" translation using electroluminesc layers, optical translation masks a photoresistive layers bonded to the r of the panel proper.

The final readout device to claim present attention is the **moving-c numerical indicator,** of which "Digivisor" unit (E.A.C. Ltd.) is best-known example. Designed primar for low cost applications, this type device is not widely used on account the relatively lower reliability of a m ing mechanical device compared with fully electronic system.

It is discussed here primarily for sake of completeness. But also beca the drive arrangement employed p vides an excellent introduction to concept of **digital-to-analog conv sion,** which is to be discussed in so detail in the next article of this ser

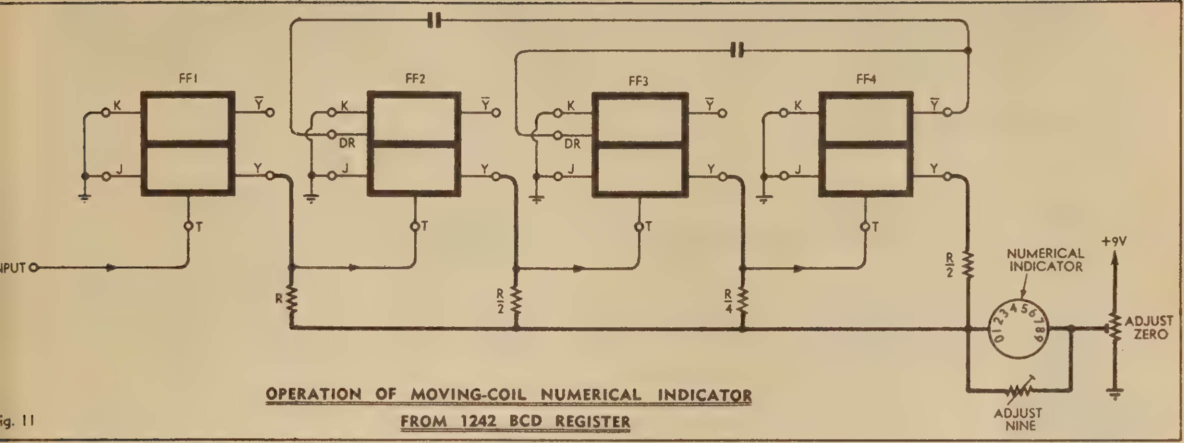
As may be seen from figure 10 construction of this type of device sembles that of a conventional movi coil microammeter. The difference that in place of a pointer and dial sc the numerical indicator has a sn microfilm transparency which car the numerals or symbols to be displ ed. A small lamp and optical syst projects an image of one of the n erals on to a finely ground glass vi ing screen; which numeral is proje and displayed depends upon the def tion of the moving coil, which in t depends upon the coil current.

Fairly obviously, this device requir drive signal which is not in the form a set of "on-off" signals, but rather the form of a current capable of b given ten amplitude values to co spond to the various numerals. other words, it requires a many-val **analog** drive signal rather than a t valued **digital** signal.

To operate the device from a dig counting register or logic circuit requires drive circuitry capable of forming a process of digital-to-an conversion.

Digital-to-analog conversion and complementary process of analog digital conversion will be discusse some detail in the next article in series, along with the processes of coding and decoding. However, the lowing brief discussion may serve both as a rounding-off to the desc tion of the moving-coil numerical cator and as a preliminary insight the concepts to be treated next mont

Figure 11 shows the basic circ used when the moving-coil indicat used with a bi-stable register cou in 1242 BCD code. It consists of sistive summing network, in which

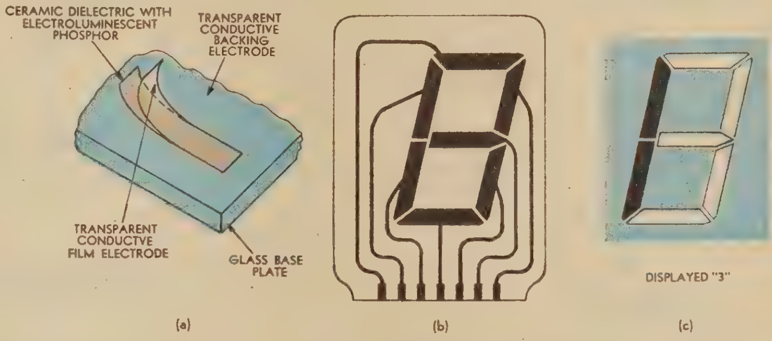

FF1
FF2
FF3
FF4
K
J
DR
T
Y
Ȳ
INPUT
R
R/2
R/4
R/2
NUMERICAL INDICATOR
0123456789
+9V
ADJUST ZERO
ADJUST NINE

ig. 11 OPERATION OF MOVING-COIL NUMERICAL INDICATOR FROM 1242 BCD REGISTER

alues of the summing resistors are in-
ersely proportional to the **binary**
eights of the counting stages—i.e., the
rst has a value "R," the second R/2,
e third R/4, and the fourth R/2. The
esistors connect from the Y output ter-
inals of the bi-stable stages through
e indicator to a variable low voltage.

The value R is arranged to be con-
derably larger than the internal resist-
nce of the indicator coil. Thus when
ny of the bi-stable elements sets to
=1, a current flows through the asso-
ated resistor and the indicator which
effectively determined solely by the
lue of the resistor.

As the resistor values are inversely
roportional to the binary weightings of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GLASS BASE PLATE
DISPLAYED "3"
(a)
(b)
(c)

Fig. 9 ELECTROLUMINESCENT INDICATOR

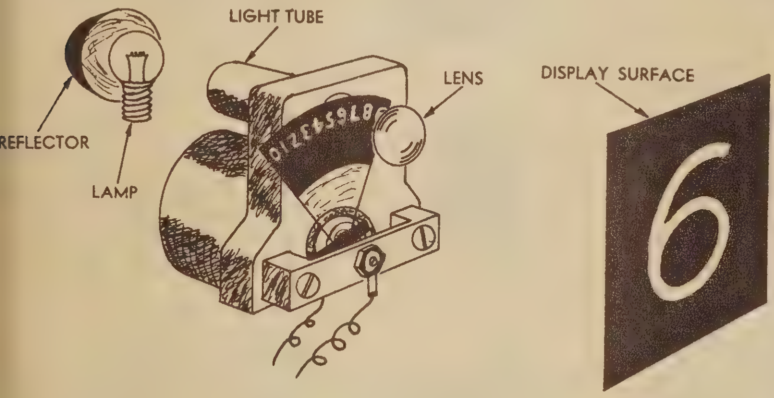
LIGHT TUBE
LENS
DISPLAY SURFACE
REFLECTOR
LAMP
0123456789
6

Fig. 10 MOVING-COIL NUMERICAL INDICATOR

e stages, this means that the setting
Y=1 of each stage produces an in-
cator current **directly proportional** to
appropriate binary weighting. Thus
e setting of FF1 produces 1 unit of
rrent; that of FF2, 2 units of current;
at of FF3, 4 units of current; and
at of FF4, 2 units of current.

Hence any combination of values in
e four stages produces a correspond-
g analog current value through the in-
cator. If FF1 and FF2 are both set,
units of current flow, and so on.

The adjustable shunt across the indi-
tor coil is simply for the purpose of
librating the "9" indication. Hence
a practical case the indicator may
ve a basic sensitivity of 250uA, while
e value R is chosen to give unit cur-
nt steps of 30uA; the shunt is then
ed to accurately set the effective sensi-
ity at 270uA for a "9" reading.

Finally, the adjustable return voltage is used to adjust the "0" indication by nulling out any residual current which may otherwise be present when the bi-stable stages are all reset. With most practical bi-stable stages there tends to be such a residual current because the output voltage is rarely absolutely zero in the reset state. Usually it is of the order of 500mV, representing the voltage drop across a saturated transistor or other semiconductor device.

SELECTED BIBLIOGRAPHY

DEAN, K. J., **Digital Instruments,** 1965. Chapman and Hall Ltd., London.
"Decade Indicator Operates Off Transistors," in **Electronics,** 3rd November, 1961, p. 60.
GREENBERG, I., "Electroluminescent Display and Logic Devices," in Weber, S., **Optoelectronic Devices and Circuits,** 1964. McGraw-Hill Book Co., Inc., New York.

(To be continued.)

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†Sensitivity : −52 dB±3 dB,
Dimensions : 148×48×34.5 mm without stand
Cable : 4 ϕmm, 3 m
Weight : 1¼ lbs (525 g)

DF-1DE

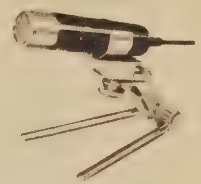
SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~10,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 385.5 mm high
21 mm diameter, microphone
128 mm diameter, stand
Cable : 4 ϕmm, 1.5 m
Weight : 1⅝ lbs (840 g) with cable

*DF-14B

SPECIFICATIONS
Impedance : 50 kΩ Variable
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −48 dB±3 dB,
Dimensions : 136×75×47 mm
Cable : 6 ϕmm, 4 m
Weight : 2 lbs (900 g)

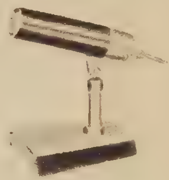
*DF-22B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±7 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 32.5 mm diameter, 220 mm long
Cable : 6 ϕmm, 4 m
Weight : 1¼ lbs (575 g)



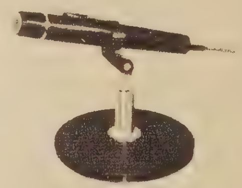
DF-1/*DF-1B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 21 mm diameter, 82.7 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 3.9 oz (110 g) with cable



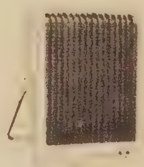
DF-3

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±8 dB
†Sensitivity : −56 dB±3 dB,
Dimensions : 33.5 mm diameter, 133 mm lon
Cable : 4 ϕmm, 1.5 m
Weight : 9.0 oz (255 g) with cable



DF-12/*DF-12B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 80~12,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 23 mm diameter, 158 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 6.3 oz (180 g) with cable



*DF-2B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±10 d
†Sensitivity : −56 dB±3 dB,
Dimensions : 75×53×30 mm
Cable : 3 ϕmm, 1.5 m
Weight : 4.8 oz (136 g) with cable

*DF-51B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~8,000 c/s±7 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 98×58×36 mm
Cable : 6 ϕmm, 1.6 m, Coiled
Weight : 7.3 oz (207 g) with cable

* with switch : † at 1,000 c/s, 0 dB=1 V/μ bar

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Solid-State, Breakerless Magneto Ignition

Solid-state electronics is no longer news in connection with conventional coil-ignition systems. More recent work has shown the feasibility of applying solid-state techniques to the time-honoured magneto system. This article, condensed from a paper presented to the Society of Automotive Engineers (Detroit, Jan. 10-14, 1966) reports work with simple engines, as used in portable power tools, particularly chain saws.

by Glen A. Guernsey and Elwin J. Brayley*

The desirability of eliminating the reaker points from ignition systems as long been recognised. Points are bject to corrosion, damage from echanical pounding, erosion, and surce contamination. The rubbing block self is subject to wear, can cause cam ear, and presents problems in selection proper material and lubricants. reaker points, at best, are a prime umbling block in the path of developent of truly long life, durable ignition stems.

A great deal of development work as been done in the field of breakerless pe battery powered ignition systems. ork has likewise been done on breakless magnetos but, to the best of our owledge, these have been multiple linder applications of a rather comex nature. Moreover, most of them nploy some form of capacitor disarge.

This paper deals with a relatively mple form of a breakerless flywheel agneto having essentially standard agneto characteristics. This approach as adopted after consideration of the llowing:

1. Steep wave front capacitor discharge type ignition shows considerable improvement where spark plug fouling problems or spark plug electrode erosion problems are paramount.

2. The spark characteristics necessary to obtain these improvements are fast rise time and relatively short spark duration.

3. Ignition systems with such characteristics do very well on certain types of applications but become marginal on some and completely unsatisfactory on others.

4. An extremely fast rise time, short duration, limited energy spark may well cause some engines to misfire or malfunction, usually under conditions associated either with particularly rich or particularly lean mixtures. There is not enough spark energy to ignite the mixture.

5. Conventional magneto or battery ignition systems may not be satisfactory for all engines, but they do a good job over an extremely broad range of applications.

6. While we certainly are interested in capacitor discharge systems, there are many applications where a magneto, minus the breaker points but otherwise providing conventional operating characteristics, might be preferable.

Thus, we determined that, for applications where fixed timing is satisfactory, the breakerless magneto should have conventional spark characteristics as to rise time and duration and have output voltage and energy at least comparable to its conventional counterpart.

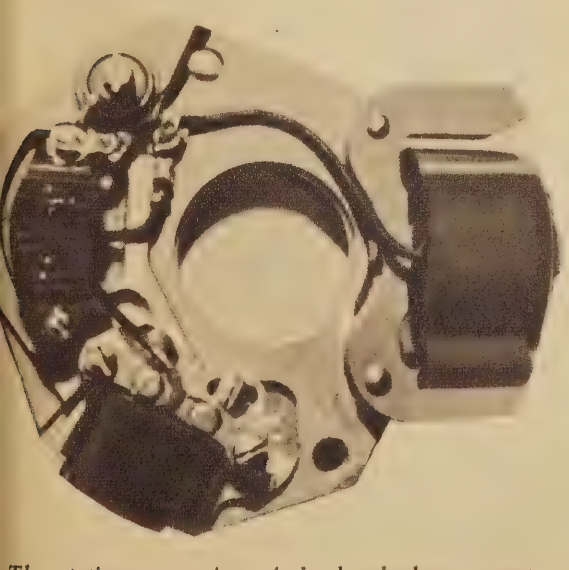
Let us review a few brief points about the operation of a conventional flywheel magneto.

1. Conventional flywheel magnetos involve relative rotation of two or more magnetic poles past a coil core with two or three poles. The coil is generally placed on the central leg of a three legged coil core or on the leading leg of a two legged coil core.

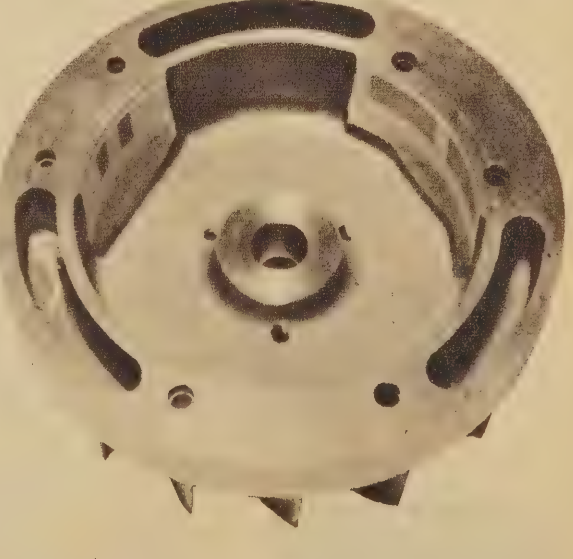
2. As the magnetic poles rotate, they establish and then reverse or reduce flux in the core leg upon which the coil is placed.

3. The breaker points in some magnetos are already closed when flux is established. In others, the points may be left open until flux has been established and then the points are closed. In either event, as the flywheel revolves and comes to a critical position, the magnetic poles cause the flux in the coil core to change. This change in flux establishes current in the short circuited primary. The current flowing in the primary impedes the flux change which caused the current establishment. As a result, the change in the direction of magnetic flux through the coil core is delayed. At the optimum time, the breaker points are opened and there is a sudden, sharp flux change. A high voltage is induced across the secondary winding which fires the spark plug.

4. In the case of a two pole flywheel operating in conjunction with a three legged coil core, let us assume that the



The stationary portion of the breakerless magneto system. On the right is the main energy coil, wound on a 3-leg core. The trigger coil is at lower left and the electronic components at upper left



An underside view of a flywheel from an experimental lawnmower type motor. The magnet pole faces are flush at the right, the smaller ones for triggering at the left.

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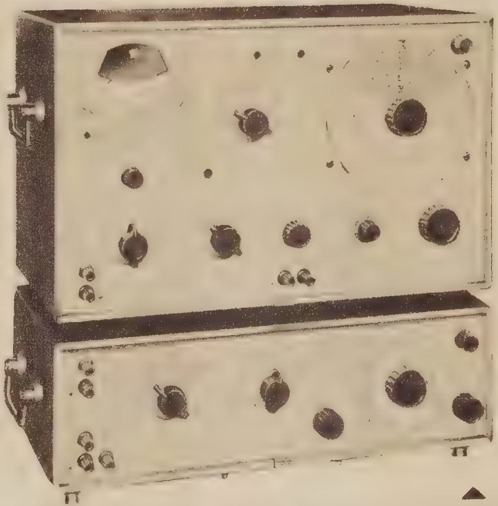

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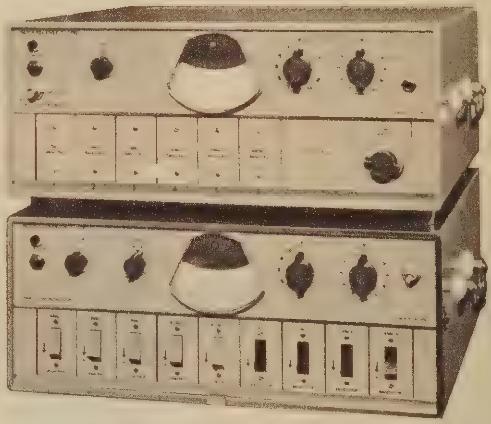

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riginal establishment of flux through
ie first and second legs causes a nega-
ve primary current pulse. The reversal
f magnetic flux which occurs when the
agnetic path switches from that includ-
ig the first and second legs to that which
icludes the second and third legs, causes
 positive primary current pulse. The
nal collapse of the flux will create a
econd negative pulse.

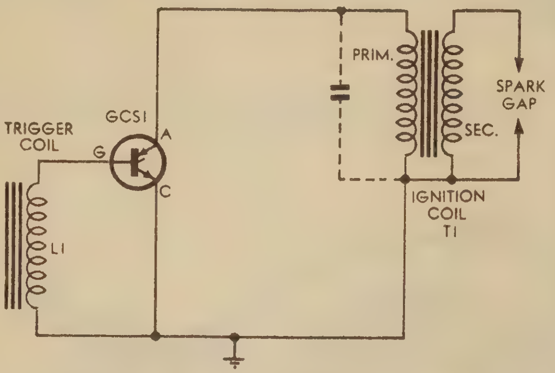

Figure 1: The basic schematic circuit for a breakerless ignition system. A parallel capacitor of selected value, as shown dotted, can optimise the operating conditions of the gate controlled switch and improve the spark characteristics.

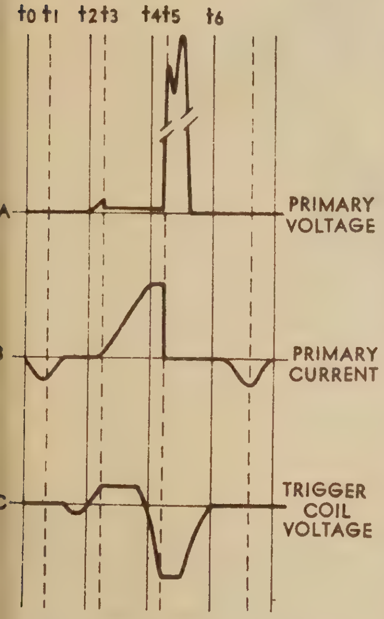

Figure 2: Typical waveshapes, showing the timing relationship between the primary voltage, primary current, and trigger coil voltage. Note that the amplitude pattern of the primary voltage has been foreshortened.

We wish to establish these points be-
ause suppression of voltage developed
 reason of the first primary pulse is
nportant.

Maximum performance from the mag-
eto normally results if the ignition spark
 obtained using the complete magnetic
ux reversal. If this is done, however,
ie preceding primary pulse of opposite
olarity can cause a so-called maverick,
 early spark. While this first pulse is
iuch smaller than that actually used to
perate the engine it can cause difficul-
es in high speed, hot running engines of
iodest ignition requirements. Therefore,
 must be suppressed or minimised. One
ieans of accomplishing this is to make
se of so-called unsymmetrical magnetic poles and coil core design to slow down the rate at which flux is established.

If the flux establishment rate is reduced, the voltage generated thereby is also reduced, and the magnitude of the maverick output will be reduced. Another method of handling this problem is to make use of a so-called cutback cam. In this approach, the breaker points are closed well before flux begins to establish. As soon as flux tries to flow, current is created which, in turn, resists the establishment of the flux. Thus, the rate of flux establishment is reduced.

With the above brief comments concerning the operation of a conventional flywheel magneto in our minds, let's look at its breakerless counterpart. First of all, the breakerless version consists of a flywheel and a stator. Both of these are similar in appearance to the standard magneto. The stator still carries the conventional coil core and ignition coil, and the flywheel still contains the permanent magnet with its associated poles; they still work together to produce the ignition spark.

We have added a magnetic triggering device and a solid state switch with its associated circuitry. These components act together to perform the functions of the breaker points. The gate controlled switch is turned on and then off so that it accomplishes the same function as the breaker mechanism.

Let us examine a simple schematic of the system, as shown in figure 1.

The components shown in the schematic, along with TWO magnet groups in the flywheel, are the basic elements of the breakerless magneto. The ignition coil is connected so that a positive voltage is generated from anode to cathode as the ignition coil magnet moves past the ignition coil. At the same time, a positive gate pulse is generated in the trigger coil L_1 by the movement of the second (trigger) magnet.

The trigger coil group's relationship to the ignition coil group on the stator is such that the positive gate pulse occurs at time T_3 (figure 2C). As may be seen in figure 2A the primary voltage has just begun to rise in the ignition coil at this time, and the positive gate pulse generated in L_1 will turn the GCS (Gate Controlled Switch) on or to its low impedance state, allowing primary current to flow as though we were closing breaker points.

The GCS has two stable states, on and off. The device can be controlled by short duration pulses applied to the gate. A positive pulse will turn it on, and it will remain on until a negative

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ulse is supplied to the gate or the node to cathode voltage falls to zero.

If we now refer to figure 2A we shall ote that at time T_3 when the GCS is urned on, the primary voltage drops to value which represents the saturation alue of the switch. When this occurs, rimary current builds to its peak value hown at time T_3 in figure 2B. At the ame time, it may be seen that the trig-er coil voltage (figure 2C) has passed s maximum positive excursion and has allen very rapidly negative. At time T_3 is negative pulse reaches a magnitude eat enough to turn the GCS off. This terrupts the flow of primary current, using the primary voltage to rise arply, and ignition occurs exactly as ough we were opening mechanical eaker points.

In figure 1, a capacitor is shown dotd across the primary winding of the nition coil. This capacitor, as placed the circuit, has a two-fold purpose. enhances the turnoff gain charactertics of the GCS and it also adjusts the ower load line of the device to safe mits. The capacitance value is slightly ss than that used in conventional agnetos to supress arcing. The resultnt secondary voltage is higher under pen circuit conditions and its rise time a little faster.

In figure 3 we have added a diode R_1 with the cathode connected to the ode of the GCS and the anode concted to the cathode. The purpose of is component is to suppress the first gative excursion of the primary volte that occurs at time T_1, figure 2A. his is to prevent pre-ignition at this me, and is analagous to the closing of e breaker points prior to or at the ginning of primary flux buildup.

Note that if a two legged coil core ith the ignition coil mounted on the ading leg were used, the diode would not be necessary. This is true because there would be a negative excursion of voltage occurring at time T_1, such as is generated in the three legged core group, as explained earlier.

With the magneto built as described in figure 3 we have a functional magneto which will exhibit long life and an exceptionally steady spark to the plug.

As may be seen by the diagrams (figure 2) in order that this magneto may perform correctly it is essential that the trigger coil's positive and negative peaks occur in the right relationship to the primary pulse. This relationship is assured by making the pole pieces of the trigger coil group and the associated poles of the trigger coil magnet group the correct width. The narrower the poles, the shorter the time between the positive and negative peaks of the trigger pulse.

Both laboratory and field tests are being conducted to evaluate these magnetos.

The design of these breakerless magnetos is perhaps even more flexible than their conventional flywheel magneto counterpart. They can be made completely interchangeable with a conventional unit. They can make use of the conventional ignition coil, or the coil parameters may be adjusted within reason to control rise time, energy, and spark duration. The approach lends itself to magnetos with internal or external ignition coils and the triggering components may be either internal or external. In the case of abnormally hot running applications, the electronic components may be remotely mounted in a cool location. Since the semiconductor devices involved are the silicon type, a mounting location remote from the normal location is not a necessity unless the application is one which generates excessive temperatures.

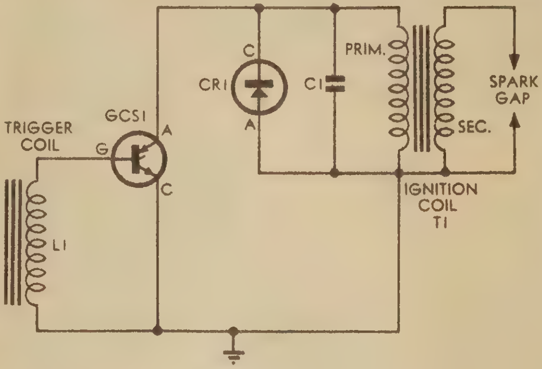

Figure 3: The basic schematic for breakerless ignition as in figure 1, but with a diode added to suppress "mavericks"—a spurious spark that can occur, due to an unduly high peak voltage during the preliminary negative excursion. (Time T1 in figure 2A).

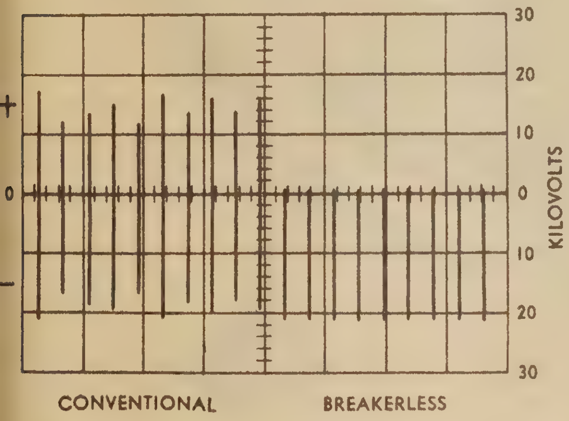

Figure 4: Comparison of the open-circuit secondary voltage showing the varying output of a conventional magnetic system and (at right) the steady output of its breakerless equivalent.

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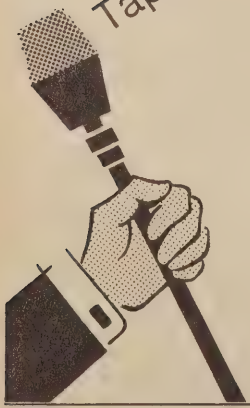

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By W. N. Williams and M. Meechan

Here is a unit which should especially interest those who are called upon to provide amplification in halls and churches. Over and above normal speech reinforcement, it will fill the listening area with good quality stereo music. If required, it can readily be set up to provide a powerful beam of sound from a 4-speaker, line source system.

Recently, the writer was faced with a personal need for a public address amplifier capable of good quality reinforcement of speech and music from stage, with an additional input channel for recorded music or sound effects, from pickup or external tape system.

The original intention was simply to put together the 17-watt public address amplifier from our May, 1958, issue and, with this in view, we secured the relevant metalwork and front panel label. (It is still selling well in 1966!) For the loudspeaker, we intended to use four Magnavox 6WRs in the line-source box (or something like it) described in December, 1961.

And then we got to thinking. If we were going to the trouble of building an amplifier, we should maybe study the subject more closely and perhaps come up with something a little different; something that might appeal to another group of readers!

One aspect of public address came immediately to mind: Most audio enthusiasts, these days, have large numbers of stereo records in their collection but when these are played in a public hall or church, it is usually over a mono system, the recordings thereby losing a good deal of their natural impact. This is irksome to the audio enthusiast, to say the least.

Why not a stereo public address system, which would do the records justice?

Fair enough, but what about the microphone channel? Few enthusiasts have stereo microphones worthy of the name, and few need them anyway. For most purposes, a single good quality mono mic. is all that is required, at the pulpit, rostrum or centre-front stage.

Then, perhaps a stereo-amplifier could be fed from a stereo pickup and a mono mic. using a couple of potentiometers, as usual, and a resistance mixing system?

A few moments with a scrap of paper showed that this would present no difficulties. The amplifier could have the normal "mic" and "pickup" volume controls on the front, along with a normal "tone" knob. Speech and music could be controlled independently or mixed, with the feature, unusual for public address, that the music would emerge in full stereo.

What about the loudspeakers?

A 4-speaker line-source system is not exactly cheap, even using the 6WRs' smaller-muscled brother, the 6PIX. The need to provide two such systems would be likely to deter all but the most affluent enthusiasts or groups.

At the same time, we could not generate much enthusiasm for suggesting a loudspeaker system lacking the good comparitive quality and the directive properties of the line-source unit.

And then came the idea that appealed immediately. Why not split the 36-inch tall line-source cabinet into two separate 18-inch units, each containing two 6WRs, or their possible equivalents in other makes?

Quality and power handling capacity would be unaffected and, in most cases, they could be placed, one in each front corner of the hall or church. So placed, two advantages would be gained:

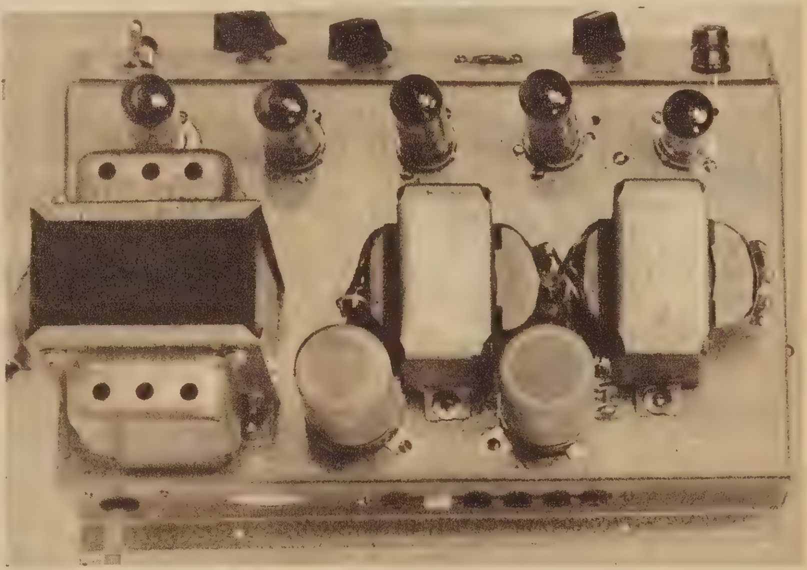
1. Music would be reproduced in full stereo.

2. Assuming a centrally placed microphone and proper cone phasing, amplified speech would appear to come from the microphone position, rather than from the individual loudspeakers. This is as it should be.

The arrangement carried promise of a bonus: In situations which called for the full beaming effect of a 4-speaker line source, the two boxes could simply be placed one on top of the other. It would then operate as a 4-speaker unit, powered from total output of two amplifiers with mono speech and, effectively, mono music.

Everything to gain and nothing to lose, as it were!

But what about the amplifier? Would



The completed amplifier, pictured at the top of the page, looks very much like its mono ancestor. Removal of the cover, however, reveals a quite different layout with one valve less than the earlier unit! The EF86 microphone preamplifier is at the top right of the picture. Note the insulated, voltage-doubler type filter capacitors and, on the rear of the chassis, the loudspeaker outlet sockets.

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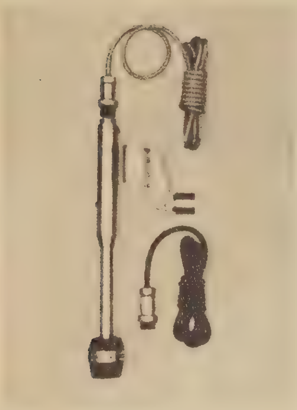

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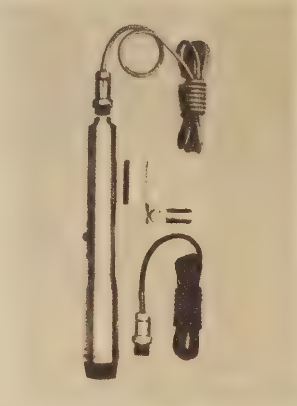

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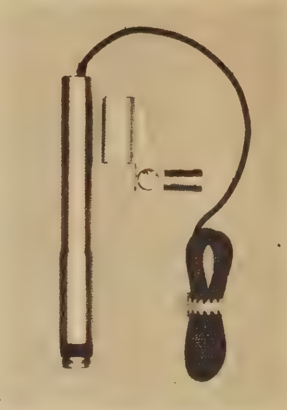

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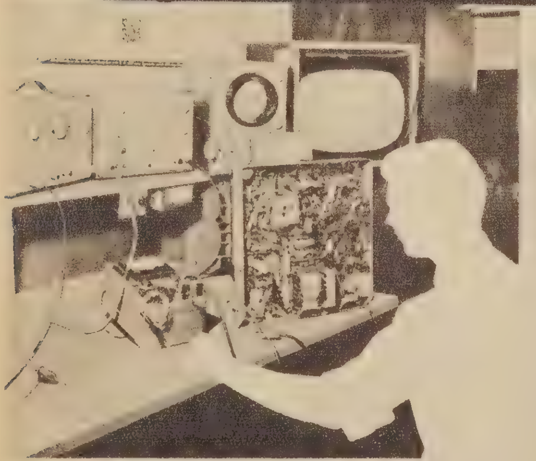

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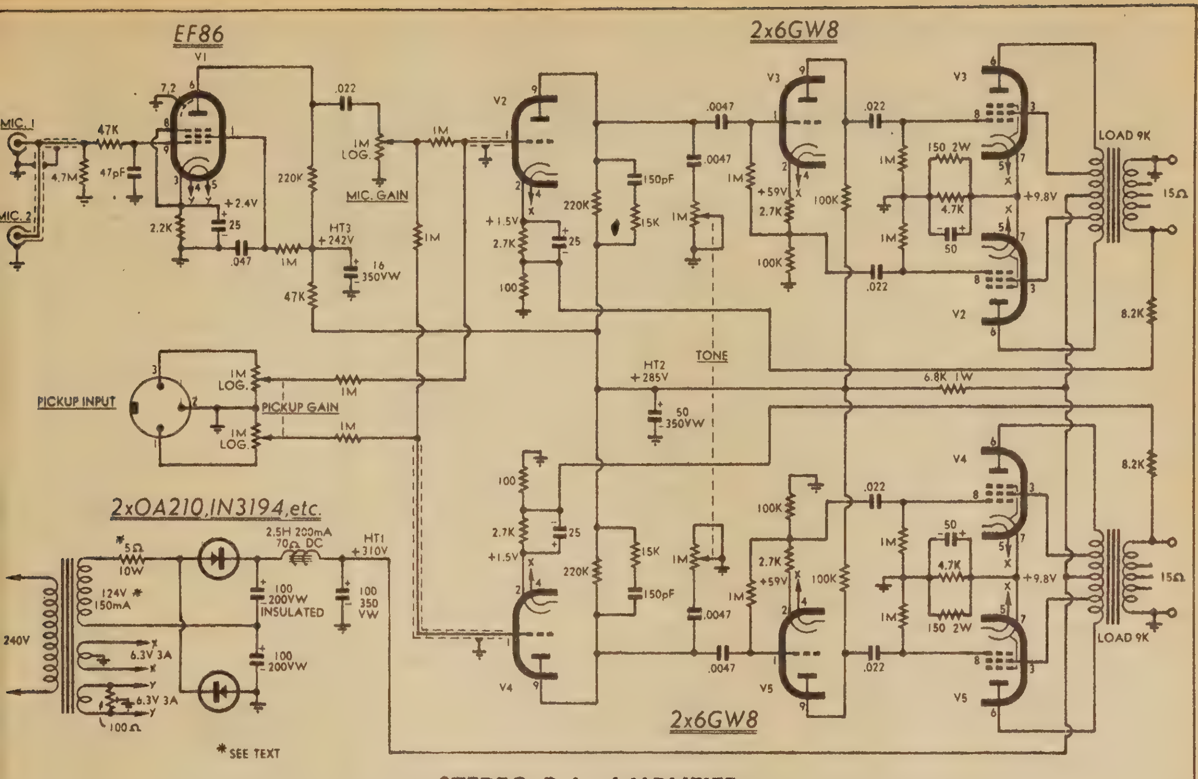

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is mean a chassis half again as large, ith the parts multiplied everywhere by vo? If it did, the scheme would lose uch of its attraction.

Hopefully, we took a closer look at e original chassis.

First off, it became apparent that, ith modern circuit techniques, we uld pension off the valve rectifier in vour of silicon diodes. Further, with GW8's now available, each containing triode and a power pentode, the basic ereo push-pull amplifiers could be proded by four such valves in line along e front of the chassis.

Provided we did not sacrifice too much ain in signal mixing and negative feedack, it should be possible to feed these mpl'fiers directly from a stereo crystal ceramic pickup.

That would leave the remaining hole ear the front edge of the chassis for a icrophone preamplifier stage.

In short, we could reasonably envisage stereo public address system with one lve envelope less than the original ono unit and with a total power outit of about 24 rather than 17 RMS atts.

Next the power transformer.

Examination of the catalogues indicad that, on much the same core and ack as the original full-wave transrmer, it was now possible to obtain a ltage doubler type rated to deliver out 310 volts DC to the input of the ter at up to 150 milliamps. Such a ansformer could be expected to cope th the demands of four 6GW8's — suming a normal speech and music gnal and a current which seemed disclined, upon subsequent measurement, rise much above 135 milliamps.

This, in fact, would leave a margin r a modest external mixer or preamplifier, where such might later be required.

Typically, the A&R power transformer PT-5891 and the Ferguson PVD-111 are rated to deliver this order of HT output, with two heater windings, each rated at 6.3V 3A. Since the proposed amplifier would require little more than 3A total heater current, the reduced wattage load could be expected to add substantially to the margin of HT drain, in terms of total transformer loading—and heating!

The Ferguson PVD-105 would also seem to be a reasonable choice. This is rated to deliver 125mA equivalent DC load from the full 146V secondary winding but, on a wattage basis, it is reasonable to assume that a good deal more than this could be drawn from the 126V section of the winding. Again, there is a wide margin of heater rating over actual load.

With power transformers of this general class taking up no more than the original chassis space, it soon became evident that there would be room on the chassis for two modern grain-oriented output transformers, as used in other stereo projects from our own and the Mullard laboratories.

Again, there is a choice of at least two almost exactly equivalent types: The Ferguson OP-412 and the A&R OT-4005. Both have multi-tapped secondaries and both have tapped primaries, allowing the output valves to be operated in the ultra-linear mode.

Both are rated as 7-watt types but this rating extends to 30Hz for high fidelity applications. We had no hesitation in considering them for a 12-watt public address application, where frequencies below about 60Hz would be of little consequence.

The ultra-linear mode is most significant in that it renders the amplifier less dependant on a high order of conventional negative feedback, thereby allowing good overall gain to be preserved.

Having positioned the output transformers, it was only necessary to locate the main voltage-doubler capacitors and the filter choke, and the major components were all safely accounted for. The filter choke, by the way, is a "television" type, characterised by very low DC resistance (70 ohms), the Ferguson F2/5 200 being an obvious choice, or the equivalent A&R unit.

In actual fact, we adapted the original 17-watt amplifier chassis for our prototype but it is our intention to issue a chassis blueprint for the unit, so that suitable metalwork should be available by about the time this article appears in print.

Along the front of the chassis, the controls are exactly as for the original mono unit and the same label can be used. Behind the panel, however, a tandem pot is used for the pickup volume and the tone control, a single pot serving for the mic. volume control.

A double-circuit input connector is necessary for the pickup, of course, and

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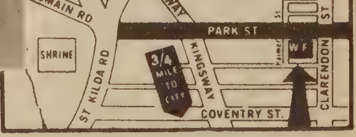

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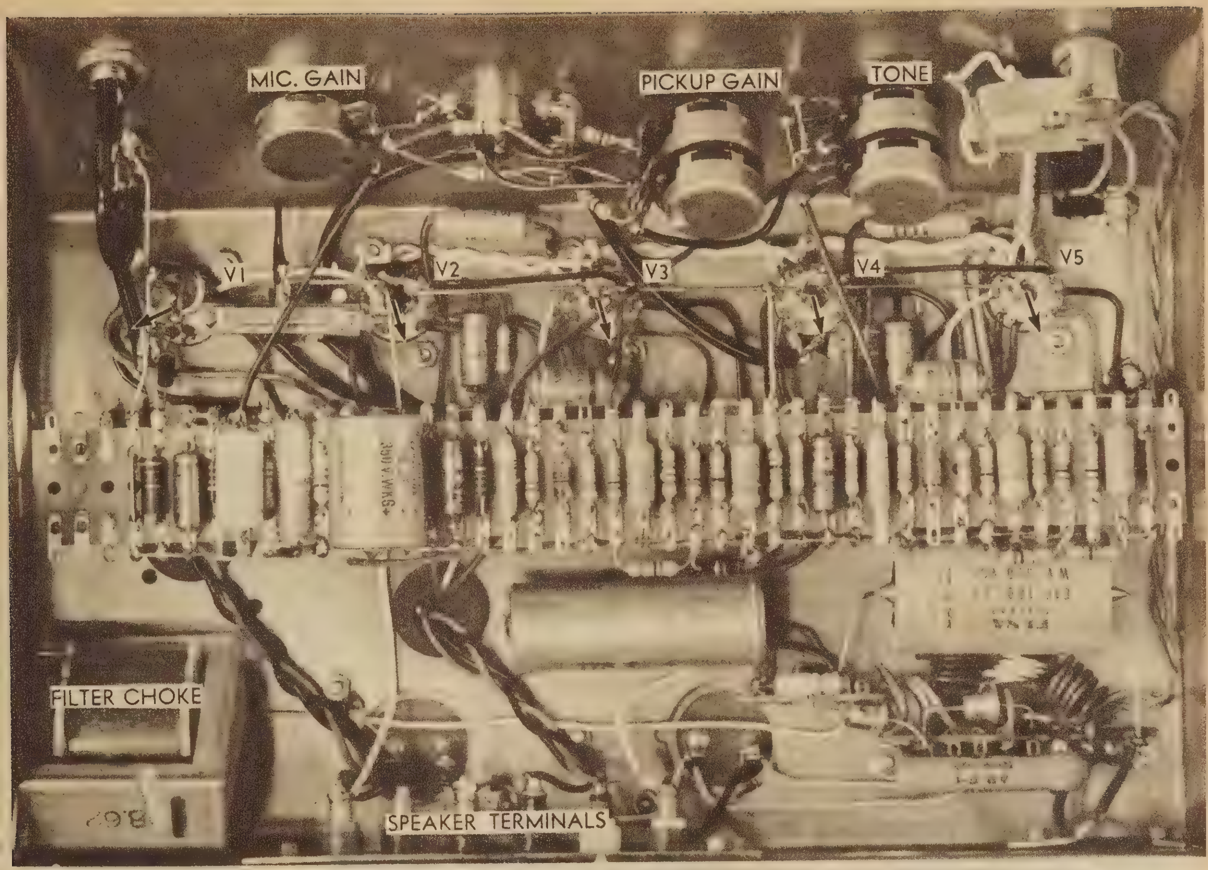

An underneath view of the completed amplifier. Note the ganged controls for pickup volume and tone and the resistance mixing component located near the pickup input socket. Diagrams on the following pages show the components on the main tagboard; also the wiring, at bottom right, to do with mains and HT supply.

we used a 3-pin DIN plug and socket for the purpose.

At the rear of the chassis, in the long cutout, we mounted 6 tip-jacks and plugs: blacks for the respective "commons," reds for the two 15-ohm connections and another colour for the intermediate impedance outlets—in our case 8 ohms.

The connections could also be wired to a socket mounted in the adjacent hole, if required.

Alternatively, this hole can be used for a socket to supply an auxiliary preamplifier or even to accommodate a 3-pin mains receptacle to operate an associated turntable. The original mono chassis had an additional provision for a supply outlet at one end of the chassis.

In general, the basic circuit follows closely along the lines of the well-proven 101 and 106 Playmasters, with one triode in each channel serving as a voltage amplifier, and the other as a phase-splitter, driving the respective pairs of output pentodes.

In this case, a conventional top-cut tone control has been provided, along with signal mixing and control facilities to the two input grids. The impedance of this latter network has been kept high deliberately, to preserve reasonable bass response with modern stereo ceramic or crystal pickups. The high impedance gives rise to a "Miller effect" loss of about 4dB at 10KHz, which is of no

PARTS LIST

1 Chassis with sloping front. (See text.)

1 Front panel 10½in x 3in.

1 Ventilated cover to suit.

1 Power transformer, voltage doubler type, secondary 126 volts AC, for 150mA DC. 6.3 volts at 3 amps., centre tapped. 6.3 volts at 3 amps. (See text.)

1 2.5 henry 200mA filter choke.

2 Output transformers. (See text.)

5 9-pin miniature valve sockets.

4 6GW8 valves.

1 EF86 valve.

2 Power diodes, OA210, 1N1763, 1N2094, etc.

RESISTORS

1 5 ohm 10 watt. (See text.)
2 100 ohm ½ watt.
1 100 ohm pre-set slider type.
2 150 ohm 2 watt.
1 2.2K ½ watt.
4 2.7K ½ watt.
3. 4.7K ½ watt.
1 6.8K 1 watt.
2 8.2K ½ watt.
2 15K ½ watt.
1 47K ½ watt.
4 100K ½ watt.
3 220K ½ watt.
11 1M ½ watt.
1 4.7M ½ watt.
2 1M-1M log ganged potentiometers.
1 1M log potentiometer.
1 16uF 350VW electrolytic.
3 25uF 3VW electrolytics.
2 50uF 25VW electrolytics.
1 50uF 350 VW electrolytic.
1 100uF 350VW electrolytic.
2 100uF 350VW insulated electrolytics (for voltage doubler).
1 47pF plastic or ceramic (not high K).
2 150pF plastic or ceramic (not high K).
2 220pF plastic or ceramic (not high K).
2 .0047 400V polyester or plastic.
1 .047uF 400V polyester or plastic.
5 .022uF 400V polyester or plastic.

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1 section of miniature tagstrip (40 connections), 2 3-lug, 1 5-lug, 1 10-lug tagstrip, 2 1in fibre rod spacers, blind-tapped 1/8in Whit. each end, 2 carrying handles, 3 knobs, 1 bezel and lampholder, 1 6.3V 0.3A lamp, 1 SPST toggle switch, 2 microphone input connectors, 1 3-pin DIN plug and socket, 6 loudspeaker output plugs and sockets, length of 3-core mains flex and 3-pin plug, length of co-axial cable, mains flex strap, rubber grommets, hook-up wire, tinned copper wire, spaghetti sleeving, solder, nuts, bolts, washers and solder lugs.

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A check in our laboratory indicated that, with typical recorded material, there was sufficient gain through the mixer to load up the amplifier with all the ceramic pickups we had on hand. With crystal pickups, there is gain to spare.

The microphone preamplifier is perfectly straightforward, giving ample gain for use with any likely crystal or high impedance magnetic microphone.

The resistance-capacitance filter at the microphone preamplifier grid is intended to provide some protection against breakthrough of modulated RF carriers, from broadcast stations or, more particularly, radio controlled cabs which are likely to drop a fare outside a public hall, then ask by radio for the next assignment.

Their conversation with the Base may be entirely relevant to their occupation but highly inappropriate if relayed over a PA, system inside the hall!

The twin microphone inputs, by the way need not be taken too seriously but they can be of use where two identical microphones are employed, which can logically be operated in parallel.

We made no attempt to provide for a balance control between the stereo channels, as much as anything because we could not afford to lose the 6dB or so of gain which a balancing system usually involves.

Provided the two amplifiers are identical, there should be very little difference in gain between them; in our prototype, it was barely measurable, let alone audible!

In the unlikely event of a difference being apparent, it could be most easily compensated, when first testing the amplifier, by shunting down one or other of the feedback resistors.

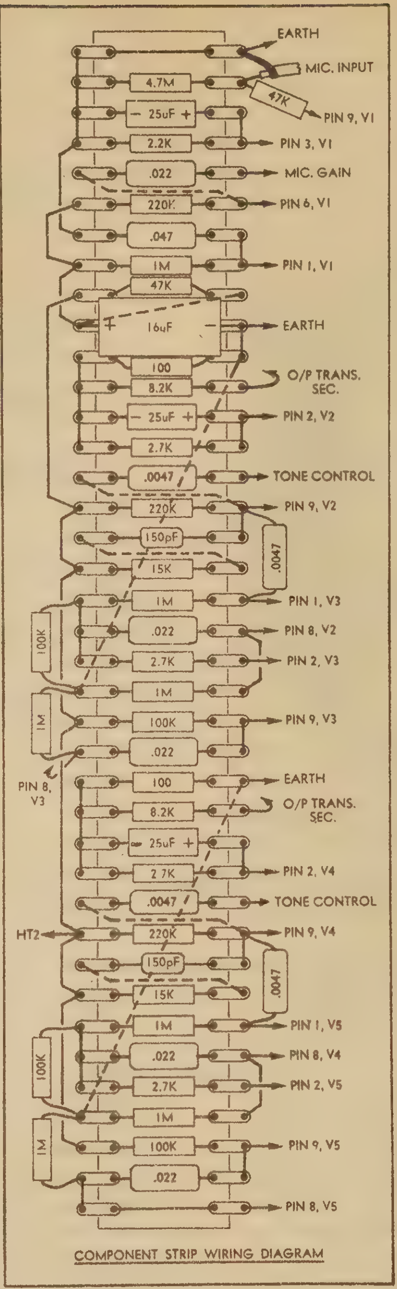
With mono signals from the mic. preamplifier, the balance should be preserved automatically. If you are unlucky enough to strike a pickup with gross imbalance between its two halves, it should be possible to cut back the loudest channel by inserting a resistor of 100K or so in series with the appropriate active lead.

A point worthy of mention is the 5-ohm resistor in the HT rectifier circuit. With the PT-5891 and PVD-111 power transformers mentioned earlier, the resistor is not necessary, either to limit peak current or DC input to filter. A resistor may need to be included, where specified for other types of transformer, or to limit the DC input to filter where it might exceed 315 volts.

Coming to the constructional side, the layout of the major components will be obvious enough from the above-chassis view.

The power transformer should be mounted so that the mains and secondary leads come through adjacent to the rear of the chassis, the heater leads towards the sockets.

The two output transformers mount with their cores deliberately at right angles to that of the power transformer and with their windings in the horizontal plane, as distinct from the vertical plane of the winding in the power transformer. Purpose of this orientation is to minimise direct hum pickup from the power transformer field.



The arrangement of components on the main tagboard. It can most conveniently be pre-wired

In both cases the output transformers mount with the secondary leads coming out the side remote from the power transformer. Where soldered connections are called for, it may be wise to attach leads to the innermost transformer before mounting, and before access to the lugs is impeded. We brought out leads from the "common," 8-ohm and 15-ohm lugs, as being the ones we would most likely require.

The voltage doubling filter capacitors can also be mounted, at least one of them needing to be insulated to conform to the circuit requirements.

Mount the four 6GW8 sockets with the blank space towards the rear of the chassis. The EF86 could use the same orientation but we chose to rotate it slightly to bring the grid pin (9) immediately adjacent to the component tagstrip.

As apparent from the lead picture, the completed amplifier was fitted with a perforated protective cover, held in place with two screws at each side. We used screws and nuts in preference to self-tappers but this can be a matter for individual choice. The cover shown is less tall that the one originally sold for the 17-watt P.A. system, measuring 4½ inches deep, plus the ½-inch holding flange.

Also available for the chassis is an underside plate, which will seal off the bottom, being held in place by self-tapping screws. It can be fitted, as desired, with rubber feet or a felt pad, to minimise risk of marking surfaces on which the amplifier may be rested.

Underneath the chassis, the filter choke mounts across the corner, handily out of the way of other components. In fact, we positioned one mounting bolt so that it could also serve to hold the perforated cover in position.

On the sloping front edge of the chassis are mounted the three controls, the two microphone connectors, the DIN socket for pickup input, the toggle off-on switch and the indicator bezel. Note that we had to turn the light bracket sideways so that it would not protrude below the base of the chassis.

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	Input Z:	1 megohm shunted by 20pF max.
X AMPLIFIER:	Sensitivity:	Better than 3V p-p/cm at 1Kc/s
	Response:	1.5c/s to 400Kc/s within -3db
	Input Z:	2.2 megohms approx shunted by 60pF max.
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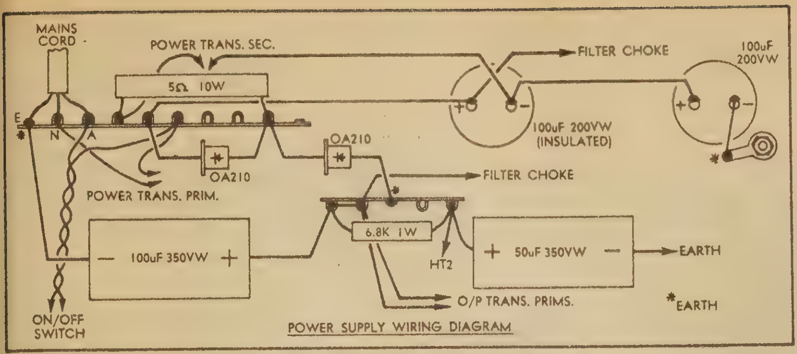

The mains and HT wiring can conveniently be arranged as shown above. Unused secondary leads can be rolled up, with a scrap of tubing over the end to prevent accidental shorts.

A miniature 3-lug tagstrip should be mounted alongside the DIN connector, using one of its holding bolts. This connector will provide a logical anchor point for the four 1-meg. resistors forming the mixing circuit and for the shielded leads which run away to the respective triode grids.

By keeping the leads short and the resistors tucked fairly close in to adjacent earthed metalwork, there is no problem with hum pickup or instability. We had been prepared to drop a shield over the assembly but, fortunately, it proved not to be necessary.

At the rear of the chassis are the four banana sockets for connection to the loudspeakers, as mentioned earlier in the text.

Also near the rear of the chassis are a couple of tagstrips for terminating mains leads and some of the HT wiring. These tagstrips are diagrammed for your guidance.

As will be evident from the underneath picture, most of the wiring components are mounted on a long tagboard running virtually the full length of the chassis. This board can be pre-wired and dropped into position with only a few external connections to be made.

It is supported most conveniently on 1-inch insulated pillars, tapped each end ⅛in Whitworth. In the prototype amplifier, it proved convenient to screw one pillar onto a power transformer mounting bolt near one end of the strip. The other screws to a bolt installed for the purpose between the two output transformers.

The end of the strip was left uncut in the prototype, to allow for possible circuit additions. It could be trimmed, however, if the space is needed for a socket providing an outlet at the end of the chassis for an external preamplifier.

The only components attaching directly to the valve sockets are the 6GW8 bias components and the RF filter at the grid of the EF86 preamplifier.

Near this valve also is the slider resistor for returning its heater supply to earth, the slider being mounted on a 3-tagstrip bolted to chassis. In many cases a fixed centre-tapped resistor would suffice but the slider gives the chance of hum-balancing, particularly if it is decided to associate a valve mixer-preamplifier with the unit.

Note also that the earth wiring for the preamplifier is separate from the rest of the earth wiring on the tagboard and is returned ONLY to the earthed lug under the microphone input connector. This single-point earthing is aimed at minimising hum pickup, due to any possible hum potentials within the steel chassis.

For the remainder of the amplifier, the earthing procedures are not particularly critical, though we have associated the tagboard earths with the valve socket side of the chassis, keeping the main power supply earths to the rear.

Perhaps the most critical part of the wiring is that involving the polarity of the output transformers and, with it, the polarity of the feedback system.

We suggest that the secondary of each output transformer be wired to place the "common" terminal logically at earth potential, bringing out the alternative impedance outputs as active leads.

This may make it necessary to reverse the primary connections if, by chance, it turns out that the feedback is positive. In our prototype, we left the respective screen and plate leads long enough to reach to either socket, merely spotting them in place. Note, however, that the plate and screen leads are associated in pairs; the outer lead and tapping from a particular side of the transformer must go to the same valve.

The amplifier can be put into initial operation without the feedback leads. Then, to make it easy, short out one stereo channel and listen to a signal through the other. Now bridge in the missing feedback lead. If the volume level drops as the lead makes contact, the feedback is the right way round and the wiring can be made permanent. The second channel can be tested in the same way or simply wired the same way round, in terms of the circuitry and colour coding.

If connection of the feedback lead causes the signal level to rise or, more likely, causes the amplifier to emit a squeal, the plate and screen lead pairs must be changed over. Before trimming the leads and soldering them into position, repeat the test to ensure that connection of the feedback now causes the volume to drop.

In our prototype unit, using the OP-412 transformer, the black and green leads run to the output valve fed from the phase splitter cathode, the yellow and blue leads to the one fed from the plate.

And that, broadly, is about all there is to the amplifier proper.

Next month we plan to have something to say about loudspeaker systems suitable for use with the amplifier with, perhaps, some remarks about microphones, pickups and the use of public address systems in general. ▬

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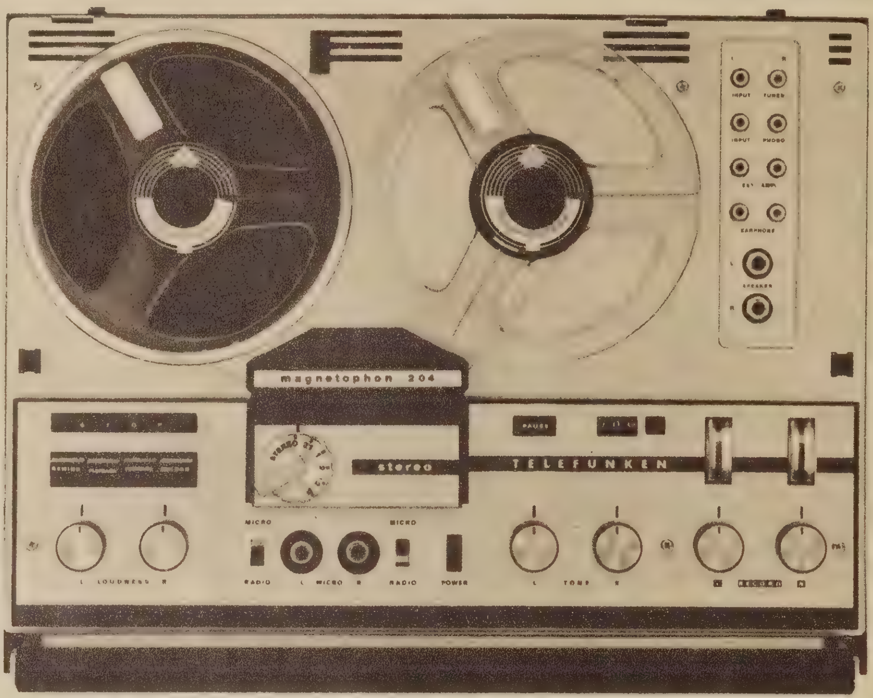

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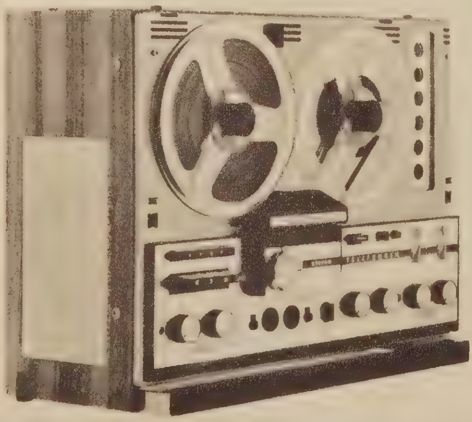

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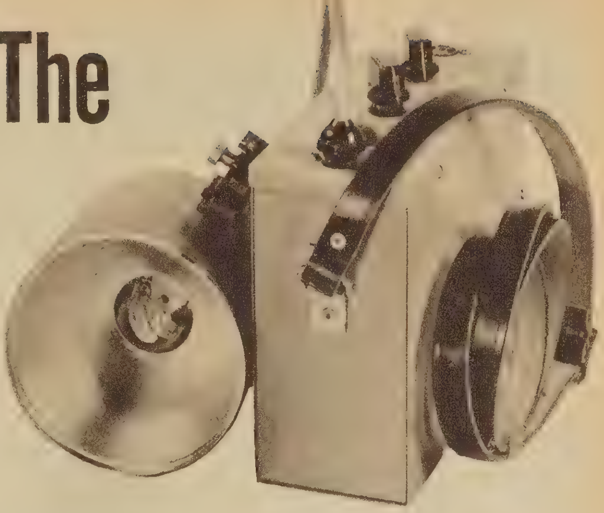


This is the second of the practical articles on the construction of an electronic flash unit. It covers flash tubes, reflectors, trigger circuits and their assembly; storage capacitors, batteries, circuit modifications for "half power"; a carrying case and the assembly of the components into a complete unit, and typical performance figures.

By Philip Watson

Before discussing the assembly of the complete unit it is necessary to consider a number of essentially practical matters concerning the components and hardware, such as flash tubes, reflectors, main storage capacitors, trigger circuits, etc.

We have had an opportunity to test three different makes of flash tube during our experiments; two imported and one locally made. Availability of a least two of these, one local, appears to be good at the time of writing, with the position of the third one not yet clear.

Regardless of the type used, the following precautions should be observed to ensure good tube life. Due to what appears to be to be a distinctly nonlinear characteristic of the discharge resistance of these tubes, it is desirable to include some form of current limiting device in series with the tube to restrict the very high peak current which flows at the moment of ignition. A small amount of resistance, such as normally provided by the lead from the main unit to the flash head, is generally sufficient.

Most tubes are polarised, or have a definite anode and cathode, and this point should be clarified at the time of purchase. Usually, the cathode is the larger of the two elements, sometimes in the form of a wire spiral wrapped around the main lead wire, and sometimes as a flattened extension of the lead wire.

Another point to consider is whether the tube can be expected to fire reliably on reduced voltage, assuming that this method of reducing power is to be employed. We will have more to say about this later. In some cases it may be necessary to modify the trigger circuit so that it operates at the same energy level, regardless of whether the main storage capacitor is charged to the higher or lower voltage.

The reflector, one of the main components which have proved a problem in the past, should be readily available from at least one source, in at least three varieties, by the time this article appears. We have also had an opportunity to try an imported unit which may become available, while there is also a chance that another Australian manufacturer mav go into production.

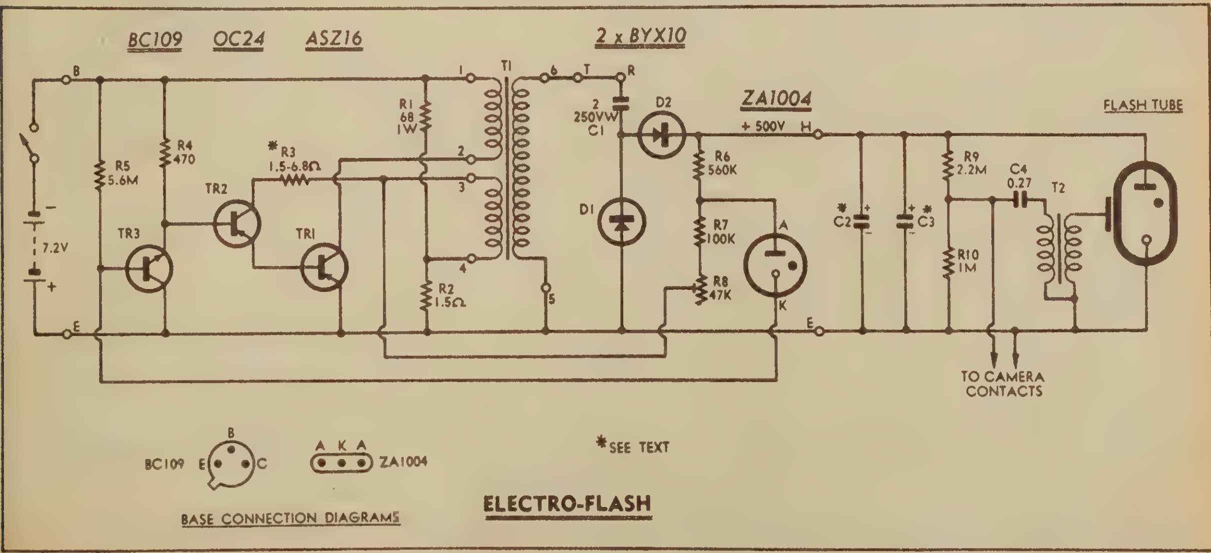
Two of the three reflectors already available are four-inch diameter types of anodised aluminium, with a special "grained" surface which appears to give high efficiency and even coverage. One is sold blank for use with whatever tube the constructor may have available, while the other is specially designed for use with an imported tube handled by the same firm. In fact, a reflector, tube, protective plastic cover, terminal board, and metal housing can be purchased as a unit, ready for wiring if so desired.

The third reflector is a larger—6in diameter—unit, which can also be supplied complete with tube, etc., if required. According to the makers the larger area gives an increased light output equal to about 1/3 stop—a useful amount if the slightly larger size is no objection.

For the smaller reflectors the best position for the tube appears to be as close as practicable to the apex of the reflector. For the larger reflector the centre of the tube should be about 1⅞in from the front plane of the reflector.

Where the tube has to be mounted in a blank reflector, the best approach appears to be to first drill a ⅛in diameter hole in the apex of the reflector and pass through it a ⅛in countersunk screw, with the head "inside" the reflector. This screw is retained by a nut and serves the dual purpose of supporting a tag strip (which, in turn, supports the tube) and retaining whatever

The basic circuit reprinted from last month's issue. Various modifications are suggested in the text.



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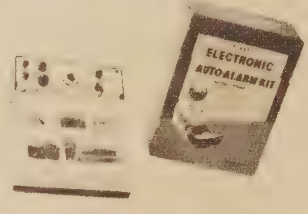

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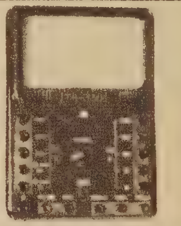

HIOKI TH-P60 MULIMETER

A pocket size multimeter, size only 2½in x 4in x 1½in, Bakelite case, weighs 10oz Sensitivity 2000 O.P.V. Ranges 0-5, 50, 250, 750, AC Volts, 0-5, 50, 250, 750 DC Volts. 0-250ma. DC Current 0-1000 ohms Resistance.

PRICE **$6.00**

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All parcels sent Registered Post unless otherwise stated. Postage or freight must be included with order.

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BRANCHES THROUGHOUT VICTORIA AND RIVERINA

kind of housing is to be used for the whole assembly. For this latter reason the screw may need to be several inches long.

Two large holes are then made either side of the apex hole to accommodate the legs of the flash tube. The best way to make these appears to be to initially drill two small holes, just large enough to take the lead wires, then enlarge the holes with a fine round file until they are large enough and in the correct position to pass the glass tube.

The tag strip is secured between two nuts on the apex screw and the tube lead wires are trimmed to a suitable length and soldered to convenient tags on the strip. Try not to bend the wires near the glass.

A fourth hole will be necessary to pass the trigger lead, and this should be made large enough to accommodate a nylex insulating sleeve. Since the voltage is quite high it would be best to use two pieces of sleeving, one large enough to suit the trigger lead and another piece large enough to encompass both.

Next to be considered is the main storage capacitor. The original 100 joule design envisaged using a total of 800uF operating at 500 volts, and some small stocks of locally made capacitors of this general type were located. In accordance with normal practice, these were in 400uF (50 joule) units, two being used in parallel for 100 joules.

Subsequently, we discovered a small stock of imported (Plessey) units, rated at 500uF, 450V (50 joules) and a lot of our developmental work has been done with a pair of these. A major point in their favour is their small size, 1.75in diameter by 4.5in high. This is only about half the size of any other units we have seen, and makes a significant difference to the finished unit.

Further investigation showed that the local distributors were quite willing to import stocks of these or any other version of flash capacitor we thought would be suitable. A study of the catalogue showed that there was available a 500uF plus 500uF, 450V unit, measuring only 2.5in diameter and 4.5in high, or a total of 100 joules in the same space needed for 50 joules in most of the capacitors we had seen. It seemed ideal for a 100 joule unit.

As a result of these discussions the local distributors have placed an order for a substantial quantity, the first delivery to be by air freight immediately they come off the production line. At the time of writing a few samples have just come to hand and good stocks should be on hand by the middle of November.

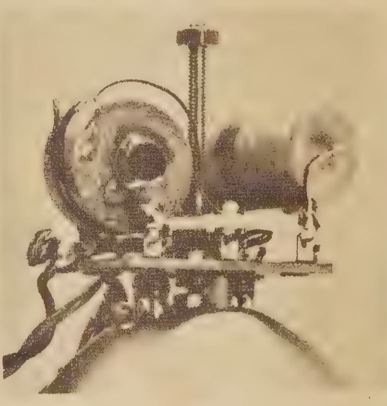
The slightly lower operating voltage of these capacitors does not present a problem in itself, the power supply being easily adjusted, by means of R8, to deliver this voltage. However, it may make the system less suitable, in some cases, to any method of light reduction involving reduced operating voltage. We will have more to say about this later.

The trigger circuit is relatively simple, but its operation is worth discussing. The resistors R9 and R10 form a voltage divider across the main supply, with about 150 volts at the junction. During the charging cycle C4 is charged to the voltage at the junction, the circuit being completed via the primary winding.

When the camera contacts are closed R10 is short circuited and C4 is connected directly across the primary winding. The resultant heavy discharge produces a high voltage pulse in the secondary winding, which ionises the gas in the flash tube.

The circuit is simple enough in concept, but involves a number of compromises in practice. In particular, it is necessary to ensure that, on the one hand, the circuit operates at an energy level high enough to ensure reliable firing in all circumstances but, on the other hand, does not impose an unnecessarily heavy load on the camera contacts.

This particular circuit was evolved by Mr Longfoot, of the Philips organisation after careful study of all the factors, and on the basis of considerable overseas research, and appears to be a very satisfactory compromise. Later, we will discuss the alternative circuit developed by Mr Longfoot, using a thyristor, aimed at reducing contact current even further.


Close-up of trigger circuit assembly on the rear of reflector.

Trigger transformers should be available from the same manufacturers who are supplying the oscillator transformer, but one is also available from one of the tube and reflector suppliers. Although not to the Philips specifications, it appears to be similar and a perfectly satisfactory unit.

As intimated earlier, the flash unit was designed around a battery made from readily available nickel-cadmium cells. Six cells are used, giving a nominal voltage of 7.2. For the benefit of those not familiar with them a brief summary of their characteristics may be helpful.

These cells are completely sealed, and the chemical action is entirely self contained. This means that they need no maintenance in the chemical sense, it being only necessary to charge them correctly in accordance with quite simple instructions.

For the user's convenience as much as anything, it is desirable to keep them on charge at all times, and this is quite permissable provided a suitable "trickle" rate is selected. On the other hand, they will not suffer any permanent damage if they are left for long periods without the benefit of such a charge. They will suffer internal discharge in such circumstances, and it may be necessary to re-cycle them two or three times in order to restore full capacity. This could be inconvenient, but no permanent damage would result.

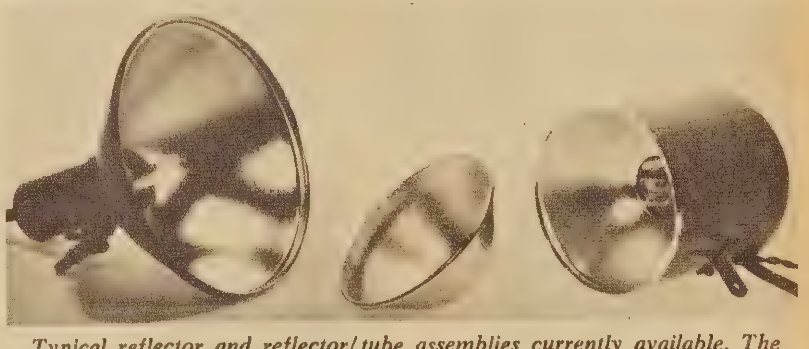
The manufacturers recommend that these cells be charged at a constant current equal to the 10 hour rate (1/10 of the amp hour figure) for 14 hours to fully charge a battery. However, no serious harm would result if this rate was continued for several hours more up to, say, another 14 hours.

After that, the cells may be kept in a near full charged condition by trickle charging at between the 50 hour and 100 hour rate (1/50 or 1/100 the amp hour figure).

For example; a 1 amp hour cell should be fully charged in 14 hours at a charge rate of 100mA. After that it may be maintained in condition by a trickle charge of between 5 and 10mA.

These cells have a long working life and an almost indefinite shelf life, making them ideal for the amateur photographer who may use them only intermittently with long periods of idleness in between.

The working life is markedly effected by the nature of the discharge/recharge cycles. Shallow cycling will give much longer life than deep cycling and the figures for half discharge/recharge cycles would normally be about three times those for full discharge/recharge cycles. Shallower cycling will give even better results. For this reason it is wise to choose a battery with a capacity in excess of requirements, other than on an occasional or emergency basis.


Typical reflector and reflector/tube assemblies currently available. The small ones are 4in diameter, the large one 6in.

For this project there are a number of button type cells available, of varying amp hour capacity, which will enable the individual constructor to select a size to suit his requirements. Typical of these is the Eveready N40T cell, which is just under 2in diameter, .394in thick, weighs 2oz, and has 1 amp hour capacity. Six of these make a stack 2.5 in high (after allowing for interconnecting leads) and weighing 12oz.

Larger versions of the same cell are the N41T and the N43T, having 2 amp and 3 amp hour capacity respectively.

PALACE 8-WATT STEREO AMPLIFIER

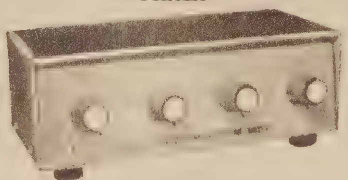
STEREO AMPLIFIER

SPECIFICATIONS:

● Output Power: 8 Watts, 4 Watts per channel. ● Frequency Response: 60 to 15,000 cps ± 1db. ● Harmonic Distortion: Less than 3 per cent. ● Hum and Noise: 52 db below rated output. ● Sensitivity: Phono (Crystal) 100mV 250K ohm Tuner 100mV. ● Tube Complements: 12AX7 x 1, 30A5 x 2, 1S315 x 1 (Silicon Rectifier). ● Dimensions: 9¾in x 6¼in x 3in. ● Weight: 5.1lb.

Price $32.50

MODEL M6 FOUR CHANNEL TRANSISTORISED MICROPHONE MIXER



All four inputs accept standard two circuit Phone Plugs, while the output jack accepts a standard circuit Phone Pin Plug.

SPECIFICATIONS:

● Input Impedance: "Hi" Impedance for Crystal Microphone, etc. ● Gain: Approximately 6 db. ● Maximum Input Signal: 1.5 volts. ● Maximum Output Signal: 2.5 volts. ● Output for Minimum Distortion: 2 volts. ● Hum: 0. ● Battery: 9 volts.

Price $6.75

BELLPHONE

Adequate for the education of children. Pick up the receiver and dial push number desired.

Price $13.50 per pair

Please Note: Clarence St., city, and Liverpool Stores are open Saturday mornings.

KALTRO SVC TV-RADIO REMOTE CONTROL LISTENER

This TV-Radio Remote Control Listener is a combination of an extension speaker and a remote control station to regulate the sound of both the TV, Radio, Phono, or Hi-Fi set and the speaker incorporated in the Listener itself. In addition, up to two earphones can be attached for listening to the sound of the TV, Radio, Phono, or Hi-Fi set without disturbing others around you. Unwanted commercials can be easily cut off by merely turning down the control of the TV-Radio Remote control Listener. A modern designed plastic cabinet with easily adjustable fingertip controls ideal for use in home, office and business. Complete with earphone, 20ft of lead wire and installation instructions.

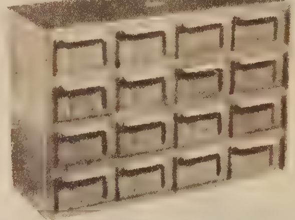
Price $8.75

CHEST OF DRAWERS

Three types of Galvanised Chests measuring 17⅛in x 6¾in x 11⅞in, containing 16 drawers, each measuring 6⅝ x 3¾in x 2⅛in.

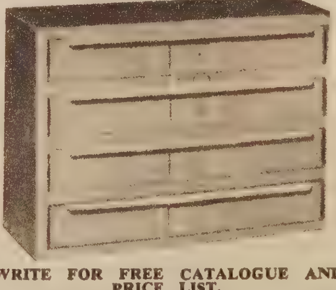
- TYPE C.D.1. With 16 undivided drawers, **$7.00.**
- TYPE C.D.2. With 16 triple compartment drawers, **$8.00.**
- TYPE C.D.3. With 8 triple compartment drawers, and 8 undivided drawers, **$8.00.**

The Chests are finished in blue hammertone stoving enamel, are complete with identification cards and packed in strong corrugated cartons. Provision is made for all units to be bolted together in tiers.



CHEST OF DRAWERS TYPE C.D.4.

A 17⅛in x 6¾in x 11⅞in Galvanised Chest containing 4 full-length drawers eahc measuring 15¾in x 6⅝in x 2⅛in. Finished in blue hammertone stoving enamel, **$7.00.**



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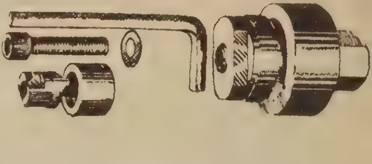


"PIPGRAS" HOLE PUNCHES

"PIPGRAS" Hole Punches are made from Alloy Tool Steel, and cut clean and accurate holes in sheet metal. They make a smooth, perfect hole without reaming or filing.

SCREW TYPE, ROUND

Supplied with "UNBRAKO" High Tensile Socket Screws and Wrenches. Cut holes in sheet metal up to 18 gauge.

Type No.	Nominal Size	Actual Size	Water Pipe Size (I.D.)	Pilot Drill Size	Price Each
32.S	½in	0.507in	—	¼in	$2.17
40.S	⅝in	0.618in	¼in	5/16in	$2.17
48.S	¾in	0.742in	⅜in	5/16in	$2.80
56.S	⅞in	0.884in	½in	⅜in	$3.80
64.S	1in	1.008in	—	⅜in	$4.10
72.S	1⅛in	1.133in	¾in	⅜in	$4.53
76.S	1/3/16in	1.172in	—	⅜in	$4.53
80.S	1¼in	1.258in	—	⅜in	$4.97
88.S	1⅜in	1.382in	1in	7/16in	$5.97

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut.

Cut holes in sheet metal up to 16 gauge.

Type No.	Nominal Size	Actual Size	Water Pipe Size (I.D.)	Pilot Drill Size	Price Each
96.S	1½in	1.512in	—	9/16in	$6.68
112.S	1¾in	1.762in	1¼in	9/16in	$7.60
128.S	2in	2.014in	1½in	9/16in	$8.33

MANUALS

Radio Servicing No. 1	$1.00
Radio Servicing No. 2	$1.75
Radio Servicing No 3	$1.50
Fault Finding No. 4	$0.88
Television Servicing No. 1	$1.50
Television Servicing No. 2	$1.50
Television Servicing No. 3	$1.00
Television Servicing No. 4	$1.25
Philips valve data Book New Issue	$3.00.

25c postage.

THIS MONTHS SPECIALS

THIS MONTH AT CLEARANCE	PRICES
Brand New 8in Speakers. 15 OHM VC.	$3.00 ea.
Speaker Transformers C Type 5000 OHM/1	$1.50 ea.
Speaker Transformers D Type 5500 OHM/3.5	$1.25 ea.
Speaker Transformers K Type 9500 OHM/3.5	$1.25 ea.
Speaker Transformers C Type 1500 OHM/2 line	$1.50 ea.
Electros: 8 MFD/300V Upright	38c ea.
40 MFD/200V Pigtail	50c ea.
24 MFD/150V Pigtail	40c ea.
10 MFD/50V Pigtail	21c ea.
20 MFD/150V Pigtail	40c ea.
12 MFD/450V Pigtail	40c ea.
150 MFD/40V Pigtail	49c ea.
42 MFD/200V Pigtail	44c ea.
8 MFD/450V Upright	40c ea.
32 MFD/300V Upright	45c ea.
16 MFD/30V Upright	40c ea.
Resistors 80 OHM 30W	75c ea.
35 OHM 25W	75c ea.
T/V Tuners Pope, Ecko	$6.00 ea.
TV Yokes, Pope, Ecko, Philips	$6.00 ea.
Push Pull Switch Pots	$1.00 ea.
Zephyr Crystal Mikes 26xa, 9ft cable	$1.75 ea.
DX62 50 OHM Dynamic mikes with on/off switch	$10.00 ea.
Paton Battery Testers Tests all dry batteries under load	$10.00 ea.
Resistance boxes	$4.25 ea.
Capacitor boxes	$2.85 ea.
Davey Rotary Investor 32V/240v/125W	$70.00 ea.
Balfour Princess Chargers	$20.00 ea.
DX Switches	$4.00 ea.

These items available at Rhodes Address only.

GENERAL ACCESSORIES

Trade Enquiries Invited

116-118 Clarence St., city, and Liverpool Stores
443 Concord Road, Rhodes. 73-0211

102 Northumberland Street, Liverpool, 602-7570
7 Pirie Street, Fyshwick, A.C.T. 90035

These are the same diameter as the N40T, but the N41T, is .719in thick and weighs 3.4oz and the N43T is .988in thick and weighs 4.8oz. The total size of a six cell battery is easily calculated from these figures.

The size of battery selected will depend on the type of work the photographer intends to do. Figures taken by Mr Longfoot when he developed this power supply indicates that a 1 amp hour battery will give about 50 flashes by the time the charging rate has risen from 15 to 30 seconds, while a 2 amp hour battery will give 100 flashes for the same increase in recycling time.

(It may be possible to shorten this time by progressively reducing R3, as suggested last month, but this number of flashes would seem to be the practical limit.)

On this basis we would suggest that the type of photographer who limits his work to purely personal pictures, and will seldom need to take more than about two dozen shots at a session, will be adequately served by a 1 amp hour battery. This offers lowest first cost and minimum weight consistent with minimum cycling depth on most occasions, giving good battery life.

For the type of photographer who does occasional professional jobs, requiring not more than 100 flashes, the 2 amp hour version would be a good compromise, while a high proportion of professional work, may well call for a 3 amp hour unit. The latter could be backed up by a spare battery, of any suitable capacity, should this seem advisable. In this case, the battery should be so fitted that it can be changed with a minimum effort. We have selected a case size and layout which will accommodate any of these three batteries.

The cells are fitted with terminal tabs (signified by the "T" in the type number) and a complete battery is made up by soldering short lengths of hookup wire, which may be bared if necessary, between the appropriate terminals.

To secure the cells into a stable stack may call for a little ingenuity. As a temporary measure we tried strapping them with plastic insulation tape, but this is rather messy and has a tendency to "creep" or "slide." Later, we managed to "scrounge" a scrap of shrinking plastic tube (from a source which must remain nameless) and this does an excellent job.

For those not familiar with the material, it has the unique property of shrinking quite substantially when heated, gripping whatever it contains and retaining this shape after it cools. In our case we inserted the battery stack inside a short length of tube, supported the battery between the tips of the fingers, and held the whole assembly in a stream of hot air from a domestic hair dryer. A radiator can also be used, but may be rather uncomfortable on the hands.

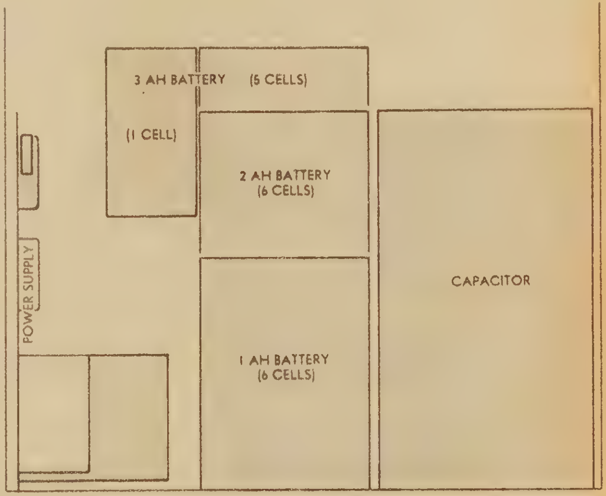
In doing this job it is important that undue heat is not applied to the battery, and the quicker it can be done the better. Normally, it should not take more than a few minutes. When the main portion of the tube has been shrunk, the surplus ends may be trimmed if necessary, then heated and folded under, "grocery parcel" fashion, to seal both ends. Naturally, suitable connecting leads will need to be fitted before the plastic.

PARTS LIST

1 Metal case, 7in x 2 5/8in x 5¾in, with lid.
Shoulder strap and fittings.
1 trigger transformer.
1 500 + 500uF 450V electrolytic capacitor with clamp type K4167.
1 0.27uF 250V polyester capacitor.
1 2.2M ½W resistor.
1 1M ½W resistor.
1 Flash tube.
1 Reflector and cover.
1 1 x 3 switch (or 2 x 3, see text).
1 2 x 5 switch.
1 4-pin miniature socket (underchassis mount).
1 4-pin plug (to suit).
2 2-pin miniature sockets, polarised (underchassis mount).
2 2-pin plugs (to suit).
2 tag strips, 8 terminal SM28.
2 pointer knobs.
Spacers, grommets, screws, nuts, washers, etc.

"HALF POWER" COMPONENTS.
1 300 ohm 3W resistor
or
1 150K ½W resistor.
1 100K miniature pot.

Unfortunately, we have not been able to arrange a suitable supply of shrinking plastic, in small quantities, though we are still trying. An alternative approach is a cardboard tube of suitable diameter, possibly plugged at one end with a disc of light plywood or Masonite, held with Araldite or something similar.



A side elevation showing how the major components are arrangea in the case, and how 1, 2, or 3 amp hour batteries may be housed. The 3 amp hour arrangement is a little unconventional, but perfectly practical.

Connection to the battery is made via a two pin polarised socket. There is a convenient commercial unit available, in black moulded bakelite, similar in general style to the popular four-pin miniature speaker socket. A similar socket is mounted on top of the complete power pack into which the charger may be plugged.

In any electronic flash unit it is highly desirable that some means be provided to reduce the light output by at least two to one. The main reason for this requirement is that there are only two ways to control electronic flash exposure; by means of the lens diaphragm or the amount of light generated by the flash. The lens diaphragm frequently has insufficient range when faced with a combination of close working and high speed film.

However, there are other advantages. In many cases the lower light output is quite sufficient for the job in hand, in which case there is little point in using more light simply because it is available. The lower output will halve the recycling time and increase the number of flashes available at a charge, while the higher output is still available for the difficult shots.

There are two popular methods of reducing light output; by reducing the amount of capacitance in the circuit, and by reducing the voltage to which the capacitor is charged. Both have their advantages and disadvantages, and the constructor can make his own choice.

Reducing capacitance is probably the easiest and, since it maintains the normal operating voltage, there is no problem of tube reliability at reduced voltage. Assuming the total capacitance for 100 joules is made up from two capacitors, it is simply a matter of switching one unit in or out as required to give 50 or 100 joules.

However, some care is necessary here. Switching a discharged capacitor across a charged one is virtually equivalent to placing a short circuit across the charged unit, and the resultant discharge current will completely wreck the switch.

We overcame this problem in a previous design (May, 1954), by using a three position switch with the centre position arranged to connect a suitable value resistor between the two capacitors. This will nearly equalise the two charges in about one second, so that it is only necessary to pause briefly in the mid-position to avoid any serious "splat." Even if a "straight through" change is attempted, the degree of splat will be small.

For 450 or 500 volt operation a resistor of between 250 and 300 ohms works extremely well, and we suggest that it be a 3W wire wound type for maximum reliability. The manner of connection is shown in the accompanying circuit.

The main disadvantage of reduced capacitance is that it shortens the flash time. Typical tubes give about 1/1000 second effective exposure when working at 100 joules, and this does not seriously encroach on the reciprocity failure region of most emulsions. However, with only half the capacitance at the same voltage, exposure time would be

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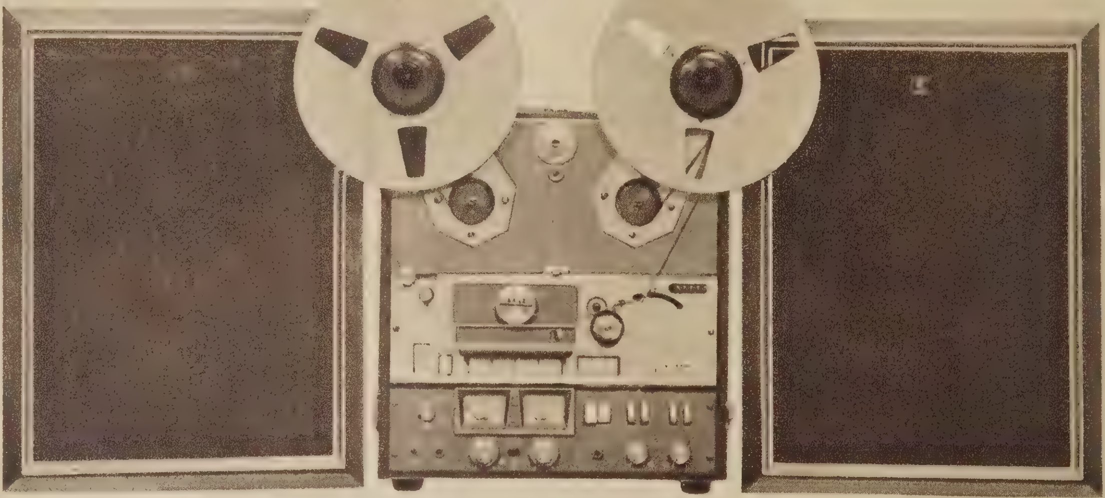
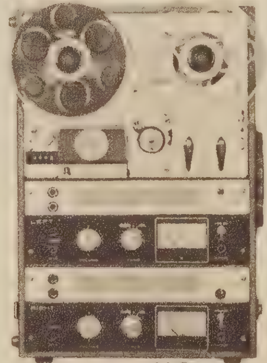
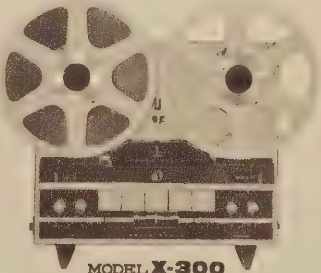


MODEL **X-355**

This is the highest quality Japanese tape recorder on the market. We created this 4-track, 3 speed stereo tape recorder for professional audio use. The X-355's solid state amplifier produces 50 watts of music power. (Attach a tuner and this amplifier doubles as an excellent FM AM radio). This tape recorder features the famous Akai Cross Field Head, which records from 30 to 24,000 cycles at 7½ ips, plus separate playback and erase heads. You can take sound-on-sound and sound-with-sound, as well as enjoy an echo chamber effect, if you wish. The dial found at the top is the automatic reverse, repeat and shut-off control. Other important features include the 10½" reel and the remote control capability. If you wish to own a 62.7 lb sound studio, have an Akai dealer show you our remarkable model X-355.



MODEL **M-8**



MODEL **X-300**

N.S.W.: Magnecord Australiasia Pty., Ltd.
210 Clarence St., Sydney
Victoria: Maurice Chapman & Co., Pty., Ltd. P.O. Box 7, North Balwyn

MODEL M-8 CROSS-FIELD HEAD PULS VERTICAL STEREO

∗ 4 track stereo monaural record and playback ∗ 4 speeds (1⅞, 3¾, 7½ and 15 ips) ∗ Frequency response — 30 to 25,000 cps at 7½ ips

MODEL X-300 10½" REEL STUDIO TYPE STEREO TAPE RECORDER

∗ Cross-field head plus 50 watts solid state amplifier ∗ 4 track stereo/monaural record and playback ∗ Frequency response-30 to 24,000 cps at 7½ ips

MODEL X-IV SOLID STATE PLUS CROSS-FIELD HEAD PORTABLE TAPE RECORDER

∗ 4 track stereo monaural record and playback ∗ 4 speeds 15/16", 1⅞, 3¾" and 7½", per sec.) ∗ Frequency response — 40 to 25,000 cps at 7½ ips

MODEL 1710 PORTABLE AND LIGHT WEIGHT PLUS HIGH QUALITY

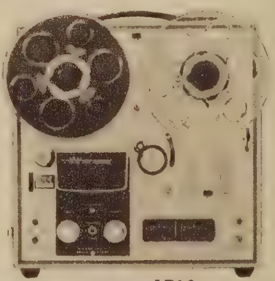
∗ 4 track stereo/monaural record and playback ∗ 3 speeds (1⅞, 3¾ and 7½ ips) and 15 ips optional ∗ Frequency response — 40 to 18,000 cps at 7½ ips

AKAI®

TAPE RECORDER

AKAI ELECTRIC CO., LTD.
HIGASHIKOJIYACHO OHTA-KU TOKYO JAPAN

MODEL **X-IV**



MODEL **1710**

Queensland: Chandlers Pty., Ltd.
399 Montague Rd., West End, Brisbane
S.A.: Nell Muller Pty., Ltd.
8 Arther St., Unley
W.A.: Tedco Pty., Ltd.
579 Murray St., Perth

earer 1/2000th second and the reciproity failure could be serious. Moreover, ne effect may not be constant from one mulsion type to another.

Maintaining the same value of apacitance and reducing the voltage (by factor of .707 for a two to one nergy drop) has the advantage that the xposure time will tend to lengthen ather than shorten and is more likely o approximate the two to one ratio in erms of exposure.

On the other hand, some tubes may ot fire reliably at the lower voltage, hich may well be outside the manufacurer's recommendations. If this mode of peration is contemplated, first determine hether the tube is suitable, by monitorng the capacitor voltage with a meter nd switching off the battery supply hen the selected lower voltage has een reached.

Flash the tube several times and, if ossible, check it in the dark, since ranky tubes often fail in this environent. If the tube seems reliable it will robably be worth while going ahead nd arranging the power supply circuitry o give either of two voltage levels, as elected.

If it seems only marginally unreliable, might be possible to overcome this by odifying the trigger circuit. The idea alter the divider network (R9 and 10) by means of the same switch wafer hat selects the required voltage level, o that the trigger capacitor (C4) is lways charged to the same voltage, egardless of whether the main storage apacitors are charged to a high or low oltage.

We have not had an opportunity to ctually try this arrangement, but we uggest that it could be done as shown the accompanying circuit, using an xtra wire between the power pack and he flash head.

For a 500 volt system the "half ower" voltage will be 350, and for 50 volts, 325. Arranging the power upply to peg at either voltage, as elected, is not particularly difficult. Reove the 47K pot (R8) and the associted 100K resistor (R7) and put these to ne side for the moment. Now replace 8 with a 100K pot and R7 with a 50K resistor.

With this configuration it should be ossible to adjust the new R8 so that he supply pegs at 325V. If not, it ay be necessary to try other values for 7, but this is unlikely.

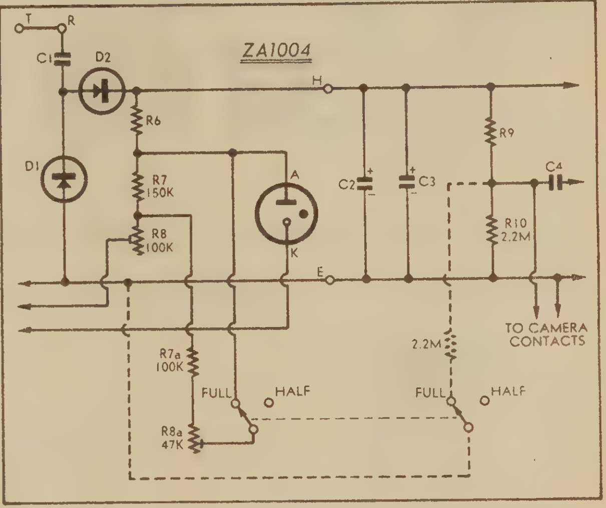
To restore the higher voltage condion the discarded 47K pot (R8a) and 0K resistor (R7a) are connected in eries and connected across the new 7 via a switch. With the switch osed, adjust R8a until the supply pegs 450V.

In case this shunting arrangement may em a little strange, in place of a raight out alternative network, we ould point out that it was chosen beuse it is easiest to add to printed wirg. Even so, the additional componts have to be accommodated and the ost convenient arrangement seems to to provide small tag strips on the derside of the case lid, close to the itch involved. This general arrangeent would be equally suitable for her switching system.

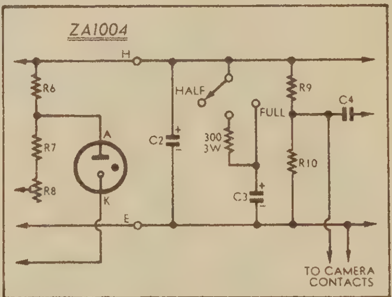
After considering all the likely reirements of home builders, we designa case which we feel will suit most them but which, at the same time, quite compact. It measures 7in x 2-5/8in x 5¾in high, is made from light gauge mild steel, and should be available with a durable Hammertone finish. Blueprints will be available in the usual way.

The printed wiring board is mounted against one end of the case, transformer end down. It is held by three countersunk 1/8in screws passing through the three mounting holes provided in the board, and held clear of the metal by three ¼in long spacers.

To facilitate fitting the board it is a good idea to make the three retaining nuts captive on the board. This is best done with a small quantity of Araldite smeared around the outside edge of the nut and allowed to flow onto the board.



Reducing power by reducing voltage. R8 should be adjusted for the lower voltage and R8a for the higher voltage. The dotted circuit is optional and is intended to retain the same triggering energy for both voltage levels. It requires one extra lead to the flash head.



Reducing power by capacitor switching. The 300 ohm resistor equalises the charge on the two capacitors, to minimise contact damage.

Since the Araldite is used only to retain the nut, no great stress is imposed on it: The same technique can be used to fit captive nuts to the capacitor clamp, as discussed later.

Before mounting the board it is necessary to ensure that all the ancillary leads are fitted and, ideally, lead off from the top of the board, rather than underneath. This is quite simple in most cases but, should underside connections be necessary, there is room to bring the leads out.

The battery occupies the approximate centre of the case, with the main capacitor at the opposite end. Provided the battery is enclosed as already described, there seems to be little point in going to a lot of trouble to secure it, but it can be packed with small pads of plastic foam.

The height of the case is sufficient to accept either the 1 amp hour or 2 amp hour batteries as a single stack. The 3 amp hour is a little too large to be accommodated in this way, but five cells can be mounted in the main stack, with the sixth mounted beside it in the space near the printed board and above the transformer.

The main storage capacitor is secured by means of a 2¼in diameter clamp mounted on the bottom of the case. It should be available from the same firm that supplies the capacitor and, in fact, should be ordered with it. It is a Ducon part, No. K4167.

As with the printed board, it is held by two countersunk screws, this time through the bottom of the case, in conjunction with two captive screws. These can be made captive by soldering, but we found it much easier to use Araldite.

All the controls and the inlet and outlet sockets are mounted on the lid of the case. Nearest to what may be termed the "front" is the four-pin socket into which plugs the flash head. This is the capacitor end of the case. Behind it, where it can be easily seen by the user, is the neon indicator, then the "ON-OFF" switch, the "HALF-FULL" switch, and, finally, the two-pin charger input socket.

Incidentally, both the sockets are available in either above-chassis or under-chassis mounting types, and we suggest you make sure you get the under-chassis mounting types, for best appearance and simplicity of mounting in this application.

Two tag strips are mounted along with these sockets. One supports the "half power" components, either the 300 ohm equalising resistor or the 100K resistor and 47K pot, according to the circuit employed. The other provides terminals for the ZA1004 neon which is most easily supported in a rubber grommet mounted in the lid of the case.

It may be necessary to modify the mounting foot of these tag strips in order to accommodate them alongside the socket and it may even be worthwhile soldering the foot to the metal socket support, to facilitate the whole assembly. The older, more robust type of tag strip would appear to be preferable here.

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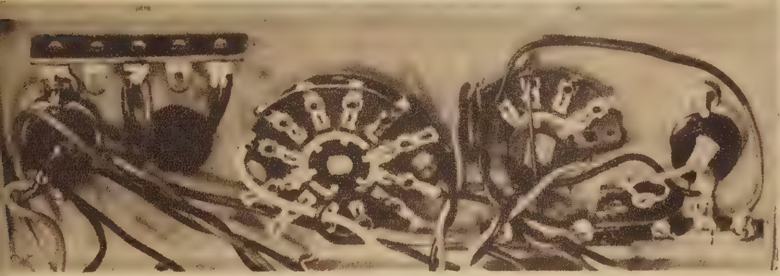
The "ON-OFF" switch is worthy of me comment. In its simplest role this ed be nothing more than a single-pole o-position type, but we elected to fit a o-pole, five-position type in anticipa- on of one of the refinements previously scussed. Initially only one pole need be ed, with its associated contacts so red that four of the five positions all present "ON."

Later, the second half may be wired that successive positions connect ap- opriate resistors across R3 to reduce value and off-set the lengthening re- cling time as the battery discharges. lues will probably have to be determin- xperimentally, as in the case of the ginal R3, and should be based on re- ning the 15 second re-cycling time. A gical arrangement is for the first "ON" sition to represent the maximum value R3, and to be used for, say, the first flashes. Subsequent positions may also selected on a number-of-flashes basis.



The underside of the case lid, showing arrangement of controls. The flashhead socket is on the left, then the neon lamp, the ON/OFF switch, the HALF/FULL switch, and the charger socket.

The "HALF-FULL" switch is a single- le three-position type. The mid posi- n will serve a useful function only it is employed to switch capacitors t, in the interest of uniformity of any hed label that might be produced, we ggest that the same switch be used gardless of the type of "half power" cuit used.

Incidently, we strongly recommend use of pointer knobs, as distinct from dicating knobs, for both these switches, order that their position will be im- ediately evident, even in the dark.

The charger socket is almost self- planatory. Wired in parallel with the ernal battery plug, it enables the bat- y to be charged by simply plugging in external charger.

The finished unit is particularly neat d compact and, with a 1 amp hour ttery, weighs a mere 4lb 8oz. It can carried for long periods without igue and all the controls are readily hand.

Finally, a few words about perfor- nce, in the photographic sense. Natur- y, this is dependent a good deal on efficiency of the tube and reflector ed, but our best results to date have en very gratifying.

We tested the light output by photo- phing a fixed subject, first with a No. xpendable bulb to provide a reference, n by the electronic flash at various ertures. The subject was 15 feet from camera and there was very little light lection from adjacent walls.

The expendable bulb exposure was as ommended by the maker; f11 at 1/25 ond. The electronic flash exposures ranged f5.6 to f22, using a high shutter speed to minimise the effect of any residual light, which was at a negligible level anyway.

The film, Ilford FP3, was processed for the mormal time in ID11 (D76) and the negatives compared. The electronic flash negative which most nearly matched the expendable bulb negative was then selected, and identical enlargements made from each, varying only the enlarging exposure time to achieve the best possible match between the two prints.

The result was both gratifying and a little surprising. We selected the f11 negative as being the closest to the expendable bulb negative and, on comparing the enlarging exposure time, it was found that the electronic flash negative needed marginally more exposure than the bulb negative; indicating that the electronic flash was producing at least as much light, and probably a trifle more, than the bulb.

On this basis we could safely use a guide number of 160 for ASA125 (FP3) film on "full power," or about 125 for the "half power" condition, and this is very good indeed. This was using a locally made 4in reflector with an imported tube, but the 6in reflector will give a better performance again.

Next month we hope to discuss a simple battery charger and the use of a thyristor in the trigger circuit.

In the event that some of the unusual components are not immediately recognised, we suggest that dealers contact the following firms:

FLASH TUBES

National Photographics (Australia), 15 Bundabah Avenue, St. Ives, N.S.W.
Hogan Electronics Pty. Ltd., 17 Gibbens Street, Camperdown, N.S.W.
Craftsman Glass Pty. Ltd., 460 Bexley Road, Bexley, N.S.W.

REFLECTORS

Craftsman Glass Pty. Ltd., 460 Bexley Road, Bexley, N.S.W.
National Photographics (Australia), 15 Bundabah Avenue, St. Ives, N.S.W.

CAPACITORS

Ducon Division, Plessy Components Group, Box 2, P.O., Villawood, N.S.W.

TRIGGER TRANSFORMERS

R.C.S. Radio Pty. Ltd., 651 Forest Road, Bexley, N.S.W.
Telecomponents Pty. Ltd., Mitchell Road, Brookvale, N.S.W.
National Photographics (Australia), 15 Bundabah Avenue, St. Ives, N.S.W.

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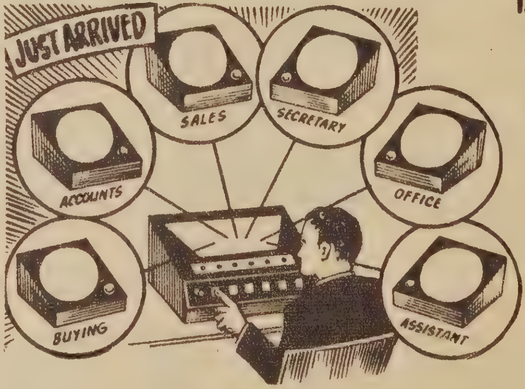

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The Serviceman

FINDING FAULTS THE FACTORIES MISS

The average serviceman normally assumes that the item he happens to be repairing was originally in first class condition, at least when it left the factory. It is not often that a major fault gets past the factory inspection system but, when it does, it can present some puzzling symptoms.

My main story this month concerns a TV set which, according to the customer, needed ". . . a real good overhaul." As it turned out, this was a fairly accurate description of its condition, though not a very helpful one in terms of servicing. When I pressed for more specific details, the owner obliged with a most impressive list: badly distorted sound, a tendency to lose horizontal sync, too much interaction between brightness and contrast controls, and erratic channel selection.

Well, I asked for it.

On the workbench it was quickly evident that the owner had not exaggerated concerning the sound; it was absolutely shocking. In fact, I never cease to wonder at what people will listen to in terms of distortion while ever there is a picture on the screen.

Seeking out the 6BM8 sound stage I ran the multimeter prods over it. This revealed a ridiculously high cathode bias voltage on the pentode section, due, in turn, to a bias resistor, nominally of 270 ohms, which now read around 10K. A new resistor and associated electrolytic soon put things right in this section.

Next, I checked the horizontal sync. It certainly was touchy, which was most unusual for this model. I was debating the most likely cause when I happened to notice the stabilising coil in the plate circuit of the horizontal oscillator and, more particularly, the adjustable core. It was nearly half out of the former, and I was willing to bet that it wasn't meant to be that way.

Closer inspection suggested that it had never been very effectively sealed and had probably "walked" out of the former over a period of years, due to vibration from the speaker. In the light of what I subsequently found, such an oversight is quite believable.

Re-setting the slug is not a difficult procedure but involves, among other things, shorting out the stabiliser coil. As I was doing this my finger slipped, the free end of the lead hit the chassis—and out went the 250mA fuse in the HT line.

Making a suitable comment, I fished out another fuse and slipped it into the holder. I hadn't bothered to switch the set off in the process and I naturally expected everything to come good immediately I restored the HT supply. Instead, all that reappeared was the sound, with not a sign of a picture or even a raster.

I was feeling a bit browned off by now, since the job seemed to be turning into one of those where everything goes wrong: First the fuse and then, apparently, as a by-product of it but with no logical explanation, a complete loss of picture. What next?

I checked the EHT, which turned out to be normal and, by the time I had done this, I suddenly realised that there was a faint picture on the screen. (I had left the brightness and contrast controls full up.)

More puzzled than ever, I simply stood and looked at the screen. And as I did the picture slowly brightened until, after several minutes, it was more or less back to normal and I could afford to turn the controls back a little.

Still puzzled, I decided to at least finish what I had set out to do; reset the stabilising coil. The mystery of the disappearing picture would have to wait. In fact, I finished this job without further incident and this completely cured the touchy sync problem.

Next, I had a look at the tuner. Its behaviour was a little erratic, though not as bad as the owner had led me to believe. I slipped the cover off and had a look at the contacts. They were dirty in places, but not unduly worn, and I felt that it would be safe to simply clean them this time around. Next time, it probably would mean a complete tuner overhaul.

I cleaned them with a propriety contact cleaner and lubricant, and this cured the troubles in this section. Now, what next?

There were two other routine defects I had noticed while working on the chassis. The EHT lead had been badly scarred on some previous occasion, apparently by some careless person with a hot soldering iron. The scars had been covered with insulation tape which had subsequently partially unwrapped itself, and collected a lot of dirt into the bargain.

Maybe beauty is only skin deep, but I just couldn't leave the set in that condition. I fitted a new lead.

The other fault was a cracked 6CM5 wafer socket. How it had happened I have no idea, but it seemed only a matter of time before it, too, gave trouble, so I replaced that also.

With these routine jobs completed, plus a general touch-up of height, width, and linearity controls the set performed reasonably well, but there was still the mystery of the disappearing picture, plus the fact that I was not completely happy with the brightness and contrast, or the manner in which these controls behaved. For want of a better way to put it, they just didn't "feel" right.

A complete check on all picture tube voltages seemed to be the logical first approach, although I had already established that the EHT was normal. The other voltages seemed normal, too, until I reached the second anode. Here the meter gave a momentary upward swing, then dropped to zero. At the same time the picture disappeared.

Well, that seemed straight forward enough. I imagined that one of the resistors in the second anode supply line had gone high—probably very high—and that this electrode was doing its best on a very meagre voltage. The fact that the load of even the VTVM could drop the voltage to virtually nothing gave some idea of just how high the resistor had become and also seemed to offer some kind of general explanation for the previous incident involving the blown HT fuse.

I commenced tracing the connections from the picture tube base pin, aided by the manufacturer's circuit, since I wasn't all that familiar with this part of this particular model. According to the circuit, the pin connected first to a 1.5M resistor, both ends of which were bypassed with capacitors to chassis, and then via a 150K to the B-plus boost supply line at about 800 volts.

I traced the wiring as far as the remote end of the 1.5M—the end that should have connected to the 150K—and came to an abrupt halt. There was no connection of any kind to this end of the resistor and, what was more, it was plainly evident that there never had been any such connection.

A feature of this make of set is that each soldered joint is "inspected" by an operator at the end of the production line, who signifies the inspection by placing a dab of coloured lacquer on each joint. And, in this case, the blob of solder concerned was not only smooth and undisturbed, but it carried the original dab of inspection paint.

I was therefore forced to the conclusion that this set had functioned throughout its entire working life—something like five years—with no voltage applied to its second anode. What's more, it had obviously passed through all the tests and inspections of factory production without anyone picking the fault. So much for the inspection system!

I must also confess to being somewhat puzzled by the set's behaviour in these circumstances. Not only had it worked well enough to get by but had apparently done so by acquiring a positive charge on the second anode of sufficient magnitude to permit this. This, in conjunction with an associated 0.22uF by-pass capacitor, had obviously caused the momentary reading on the VTVM when I tried to read the second anode voltage. When I discharged this capacitor, the picture disappeared.

It also explained why the picture took so long to reappear after I had blown

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the HT fuse; the second anode needed this length of time to acquire a new charge. Normally, this time would be masked, in part, by the warm-up time of the cathodes but, even if it took a little longer, the owner probably shrugged it off as being "that kind of set."

But how had the second anode acquired this charge? I'm afraid the finer points of electron streams and associated elements is a bit beyond your humble servicemen, but two possibilities do suggest themselves.

One is that the element concerned could be slightly emissive on its own account; a not unusual condition, and one which becomes quite evident in power valves, for example, should they happen to be operated with an open or unduly high external grid-cathode circuit.

The alternative suggestion is that the element could capture any positively charged ions likely to be present, assuming that the tube was not entirely free from gas—which is a resonable assumption.

Either of these effects or, more likely, both together, could have been responsible for the small positive charge on the second anode which, if it wasn't large enough to help the electron stream was at least large enough not to hinder it. Thus the set worked—in a fashion.

Needless to say, restoration of the missing link enabled the picture tube to perform as it had never been allowed to in the whole of its working life, and it responded nobly. This was one occasion when the traditional customer's comment that the set was behaving better than ever before was literally true.

Another factory-made fault I encountered recently was in quite a different setting. This time it was a portable radio, of Japanese origin, and the fault was neither subtle nor difficult to diagnose.

The customer's complaint was simply that it "didn't go;" then he went on to explain that it had been giving trouble for some time, in the form of severe burps which, at times, came in rapid succession. It was during one of these paroxysms that it finally gave a last despairing burp and packed up completely.

As a matter of course I inquired about the battery, and was assured that it was practically new. Nevertheless, my first move was to check it, since my experience of the average customer is that they are notoriously unreliable in this regard. Sure enough, the nominal nine volt battery could hardly flog itself up 7.5 volts on no load. So I fitted a new battery.

Unfortunately, it didn't help, and the set remained as dead as ever. I decided that the printed board would have to come out and, forgetting that the set was still switched on, I removed the four mounting screws and lifted the board clear. As I did so, the speaker gave forth a loud raspberry, which was reassuring, if not particularly informative.

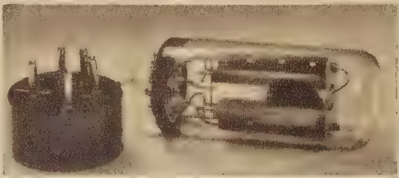
However, I noticed that, as I moved one of my fingers holding the edge of the wiring board, more raspberries were given forth. I quickly discovered that said finger was resting on the end of a small resistor and, as the resistor moved, so the speaker squawked.

Closer investigation showed that one pigtail was quite loose and could be withdrawn from the hole in the board. It had obviously never been soldered. To be sure, there was a complete coating of solder on the other side of the board, but this had never reached the pigtail.

The real cause of the trouble, as far as I could determine, was that the pigtail had been so cut and trimmed that it failed to emerge on the solder side of the board. As a result, during the subsequent dip soldering process, it was left untouched.

Unfortunately, probably due to some minor distortion of the board when it was screwed into the case, there was enough pressure to force the end of the pigtail against the solder. And so the set worked, at least long enough to pass the factory inspection. It continued to work in the field too, for a while, then developed the intermittent burps as a prelude to final failure.

It took only a few seconds to reshape the pigtail and to make sure it was well and truly soldered. It was one of the quickest jobs I have done for a long while. And once again I had the pleasure of hearing the customer remark that the set was performing better than ever — and of knowing that this was really true.


Unusual valve damage. This valve took most of the weight of a dropped mantel set. The force snapped each lead wire clean off against the glass pinch, yet left the glass envelope completely intact.

Finally, here is a story about a novel speaker fault in car radios, but one which I have encountered several times recently. This particular case was not the first I had encountered but it was typical.

The customer drove up to the shop and asked me to listen to the set. His complaint was that the set was apparently getting progressively weaker and now needed to be turned flat out in order to get even a moderately loud signal from local stations. There was also some evidence of distortion, but he wasn't very emphatic about this.

We went out to the car and switched the set on. As I waited for it to warm up I took note of the surroundings. It was a modern station waggon, fairly obviously belonging to a commercial traveller, used to doing long country runs. The speaker was mounted under a near horizontal dashboard grille, provided as part of the car's decor.

When the set warmed up it behaved very much as the owner had described it and, while the trouble could have been due to a number of causes, I had a feeling I could pick it in one. I. reached up under the dash and managed to get a couple of fingers against the back of the speaker cone. Even with moderately substantial pressure applied, I could detect no cone movement.

"Your speaker has 'had it,' I'm afraid," I told the customer, although I could see he wasn't too happy with the verdict.

"I haven't had the set very long," he complained. "And besides, why should it go gradually like that. I imagined a speaker would either work or not work, from what I know of their construction."

"That's fair enough," I agreed, "and I agree that the symptoms are a little unusual. But stick around, and I think I can show you what's happened."

Undoing the four mounting screws I gently eased the speaker free, taking care to disturb it as little as possible. Then I withdrew it completely and placed it, still face up on the seat.

I didn't have to say anything. In the centre of the cone was a bed of fine dust, deep enough to completely cover the felt dust cover. There must have been at least a couple of teaspoonsful of the stuff.

"Well, I'm blowed," was all the customer could say.

We took the speaker inside and I emptied the dust out of the cone, then demonstrated how the cone was virtually "frozen" in the gap. At this point, the customer asked the inevitable question. Why didn't the felt dust cover exclude the entry of the dust? After all, wasn't that what it was for?

I agreed that it should, and added that it did in most cases. In this set-up, however, with cone virtually horizontal and the dust trapped in the centre, the vibration of the cone simply served to turn the felt pad into a very effective filter, whereby the very finest dust particles were forced through the felt into the annular gap. Eventually they filled the gap and there was no room for the voice coil to move. In addition, perhaps, moisture from condensation could mix with the dust, making a very effective cement.

Naturally, the customer wanted to know what could be done to prevent it. I told him that, as far as I could see, there was only one real answer: to mount the speaker essentially vertically, rather than horizontally, say in a speaker box on the bulkhead.

However, he wasn't keen on this, maintaining that the present position gave the best distribution of sound. And, I had to agree that, acoustically, the position is an excellent one. On the other hand, unless someone can solve the dust problem, it isn't likely to remain popular for long.

Finally, the customer decided to have another speaker fitted in the same position, justifying it on the basis that he could remove it and clean the dust out at regular intervals.

The idea will probably work, too — if he sticks to his good intentions. But somehow I have a feeling that I will probably be fitting another speaker in the same car in another 12 months. ◘

NOTES & ERRATA

Playmaster 113 Power Amplifier, Playmaster 112 Control Unit. (December, 1965, February-March, 1966): Some confusion has apparently arisen from the fact that the required Control Unit supply was originally specified as 22V, whereas the Power Amplifier provides only 18V for this purpose. In fact the Control Unit supply is quite uncritical and may vary from 16-24V without noticeable change in performance; it thus functions quite normally from 18V.

The contributor of the item **"Reverb. From Tape Recorder"** (Reader Built It, June, 1966, page 111) says that the sentence ending "fed into separate amplifiers" should read "fed into separate inputs or mixed into one input."

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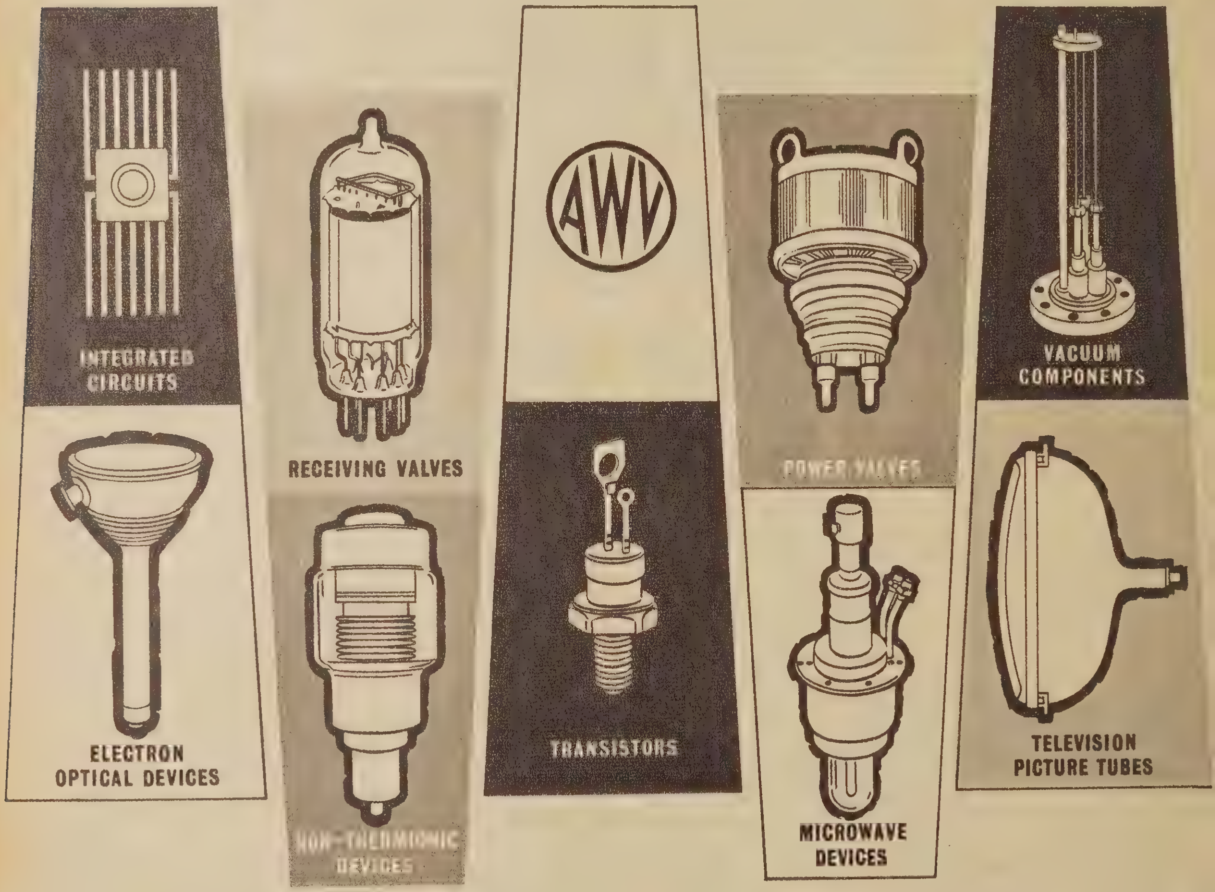
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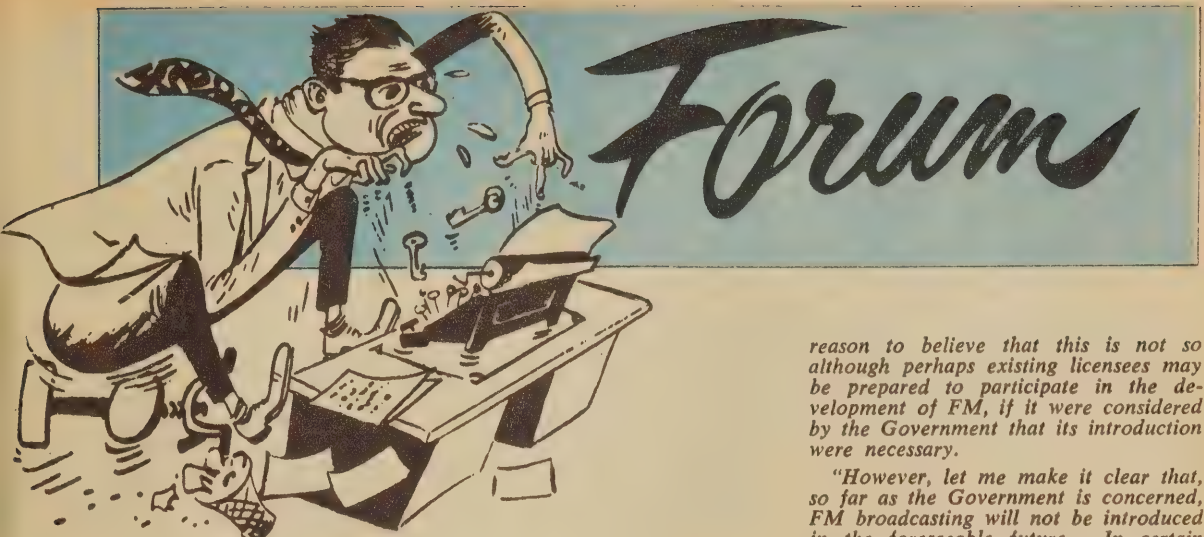

FM—"not in the foreseeable future"

Just twelve months ago, I commented in the editorial that "it would be wrong to assume that FM/stereo is almost here . . . in my book this is going to add up to years, not months." The most recent statement by the Postmaster-General on the subject would suggest that this forecast was only too true.

Conducted by the Editor

At the time it was made, one of Austtralia's leading proponents of frequency modulation felt that I was being far too essimistic. He undertook to shout me a hicken dinner if FM stereo was not well nd truly under way within 18 months.

I can smell that chicken already!

Addressing the Federation of Commercial Broadcasters in Melbourne, on October 10, the Postmaster-General, Alan S. Hulme, M.P., seemed to inicate that the Federal Government was well content with the service which Australian radio stations were provid-ng on the medium-wave broadcast band.

He spoke of four new National broadasting stations which had commenced peration since the last convention and he proposal to licence commercial roadcasting stations to serve the Gold Coast, the Atherton Tablelands and the nnisfail-Tully area, all in Queensland. He said:

"It is indicative that deficiencies in roadcasting services are to a great exent being rectified, notwithstanding the roblems we have in respect of the vailability of frequencies in the medium frequency band. These develompments have come about by a more intensive use of the medium frequency band by means of special techiques. For instance, the successful techical operation of the three new commercial stations in Queensland will be made possible by the use of directional erials."

Mr Hulme then went on to discuss his overnment's attitude to FM (Frequency Modulation) broadcasting, and I quote gain:

"This raises the question of frequency modulation broadcasting, about which I have been asked to again make some mention.

"The Government has consistently taken the view that any deficiencies in the Australian broadcasting services are not sufficient to warrant the introduction of a completely new service such as FM with its attendant problems and costs.

"Frequency modulation undoubtedly has certain merits including lower noise levels and higher fidelity of sound. It seems clear, however, from the technical submissions and information that have been supplied to me, that FM would not facilitate an improvement in the broadcasting services where such improvement is most needed, i.e, in distant country areas. Here the use of the medium frequencies is in fact more effective. There would, moreover, be some technical difficulties in regard to FM broadcasting which would have to operate in Australia in the UHF band, compared with the VHF band in countries where FM is used overseas.

"It is consistently submitted by some people that FM has arrived in many overseas countries and that Australia is lagging behind. This is not so. Indeed, the stimulus to FM overseas has been not so much because of its intrinsic merits, but because of the degree of overcrowding and interference in the FM band rising from very large populations to be provided with service. Interference and overcrowding to such an extent fortunately does not exist in Australia.

"There have been suggestions that your industry is in favour of the introduction of FM broadcasting. I have reason to believe that this is not so although perhaps existing licensees may be prepared to participate in the development of FM, if it were considered by the Government that its introduction were necessary.

"However, let me make it clear that, so far as the Government is concerned, FM broadcasting will not be introduced in the foreseeable future. In certain quarters, a recent decision to grant certain licences for FM experimental purposes in the UHF band may have been interpreted as a prelude to a reversal of the Government's known views on FM. This, I emphasise, is not the case. There is no reason at all why these experiments should not be made and good reasons why they should. But that, for now, is as far as it goes."

One can well imagine the rage and frustration of high fidelity enthusiasts at the Minister's scant dismissal of their interests. The more so, because it comes as a climax to many months of agitation by various interests at various levels.

Unfortunately, the case for FM and FM/stereo has thus far been characterised by a lot more starry-eyed optimism than appraisal of hard fact.

In conversation and correspondence, hi-fi enthusiasts are still cursing the Australian Broadcasting Commission as the organisation which no longer provides them with an FM service. As often as not, the theme is developed into a condemnation of A.B.C. policies generally.

Another group is given to blaming the P.M.G.'s Department as the guilty party, proceeding therefrom to ventilate all the things they don't like about departmental policies. Only recently, a large article along these lines was generated in the Press for public consumption.

As we have pointed out on previous occasions, this hate is completely misdirected, for both the A.B.C. and the P.M.G. technical services were highly in favour of FM broadcasting, not against it!

The planning of all aspects of broadcasting, AM and FM, mono and stereo, monochrome TV and colour TV, national and commercial, is primarily a matter for Federal Parliament, and given expression through the Australian Broadcasting Control Board.

Even the Postmaster-General, though a key figure, must conform to his Government's policies, which are dictated to a large extent by broad economic and industrial issues.

At a recent engineering meeting in Melbourne, someone reportedly made the observation that "only the stroke of a pen blocked the establishment of FM broadcasting." Remarks like that are as unrealistic as virulent attacks on the wrong people!

Over 12 months ago, in these columns, I sought to warn against the unrealistic, starry-eyed approach that was, even then, all too evident.

In the October, 1965, issue (page 85, col. 1) I referred to a major delusion among hi-fi enthusiasts, namely that the introduction of FM-stereo would automatically fill the air-waves with beautiful music, exactly to their liking.

I referred to a further delusion—that the A.B.C. and commercial interests would find a large and enthusiastic audience, sufficient to ensure immediate commercial success and reversing all the factors and preferences which have created the present sound of AM radio.

And so on. But for space considerations, I would have been quite content to reprint the remarks in toto, because they still stand in all their disturbing detail.

Let me make myself clear: We will get FM and FM-stereo broadcasting in due course, as part of the normal progress and evolution of home listening. We will get it, not at the reversal of somebody's presently annoying whim but as the end product of a lot of hard-headed political, commercial, technological and promotional planning.

FM and FM-stereo, when it comes, will up-grade the public concept of good sound reproduction but it will not exist primarily to serve high fidelity enthusiasts. Its need to find some kind of a mass audience will see to that—unfortunately!

As I pointed out in October, last year, our present AM broadcast stations are technically able to radiate some very pleasant sound, but only a very small proportion of the total audience would ever know — or seemingly want to know. The rest are content with a diminutive box, which radiates recognisable words and the appropriate beat, and little more!

You may think that I'm being more defeatist than realistic about this but it is not without reason.

A recent issue of "Sponsor" magazine, which concerns itself with radio and TV advertising in U.S.A., devotes a good deal of space to the rising role of FM-stereo in that country.

It points out that, having survived by being allowed to operate in parallel with AM outlets, FM and FM-stereo is now facing the position of having to cut adrift and to provide its own programming. To quote:

"FM has been happening all over the map for the past two years. Spurred by the imminent simulcast split in January, nearly a thousand AM/FM stations have been experimenting with FM programming twists, promotional gimmicks and sales pitches once anathema to well-bred FM.

"Who would have thought that he'd live to see the day when the deejay who calls himself 'the fifth beatle' Murray the K., would be planning to stomp it on an FM station?

"Who would have thought that, one day, he'd tune in an all-girl-deejay FM station in New York City?

"Indeed, a few years ago, who suspected that one would be able to capture in FM stereo the sounds of country, folk, folk-rock, blues, talking blues, gospel and talking talk?

"FM purists be damned, all of these formats are here and though some are even now falling by the wayside . . . FM has embarked up on a diversity of programming formats scarcely imagined by the medium's founding father, Major Armstrong, himself a classical-music buff.

So many new stations have come up with new programming sounds of late, in fact, in many areas the FM band is beginning to sound suspiciously like the AM band."

The article goes on to point out that there is still a fair proportion of classical and neo-classical programming on FM radio and that the inherent quality of the medium gives it a significant advantage for music of all descriptions. It quotes FM supporters as postulating that there will be a progressive shift to FM for all music programming, ultimately leaving the AM band to talks, news and utility services.

But this belongs to somewhere in the future, they agree.

But if and when it happens, there is no guarantee that the quality enthusiasts will be relatively more happy with mass programming then than now. They may simply be able to receive, much more effectively, what they don't particularly care for!

As I said earlier, there's a lot more to this question than the stroke of a politician's pen!

There's one twist, however, which proponents of FM will certainly appreciate. While the Postmaster-General was making his statement in Melbourne pushing FM into the hazy future, one of the world's first UHF broadcast FM transmitters was raining its signal over the same city.

Unless I'm much mistaken, this experimental signal will count for more than any number of words!

To change the subject, a certain amount of comment is still coming to hand about our recent change from "cycles per second" to "Hertz." One from P.W. (Killara, N.S.W.) is brief and to the point. He says:

Dear Sir,

I very much disagree with A. G's letter on the matter of cps and Hz. Hertz honours someone. Does cps?

Is it going to improve Australia's image if her industries don't conform to this international symbol?

Concerning the matter of the relative potential dangers of the various types of electric power, this is utter bull. A.G. seems to assume that 90 per cent of Australia's population are dolts.

Putting the other point of view, one or two letters have repeated the objection that "cycles per second" means something, whereas Hertz does not. Why, the correspondents ask, should they be expected to adopt a term which has no relationship as a word with the quantity which it describes?

The curious thing about most of this comment is that it treats adoption of the word Hertz as some kind of a precedent, with the implication: What'll they do next?

In fact, a very large number of electrical quantities are named after pioneers and we use the terms without a second thought. And "we" would most certainly include the objectors to "Hertz."

How far would we get if we were to refuse to use such terms?

We would immediately have to cut out "ampere" and try to evolve a generic term invoking the concept of the deposition rate of silver — 0.001118 gram per second — from a solution of nitrate of silver in water.

Let's begin then, by substituting a derivation from the chemical symbol and end up with, say, "Agnodep" as the unit of current!

Next, we must get rid of "Ohm," because the word has nothing about it to suggest resistance, as offered by a column of mercury of reference dimensions and temperature. Perhaps we could call the unit of resistance a "Resmerc."

That would make the volt (that must go, too) equal to the potential difference between the ends of a conductor of resistance 1 Resmerc, when the current flowing through it is 1 Agnodep! Derived from these terms we could possibly rename the volt an "Agnoresmercdep."

And so on! Unless I'm much mistaken, we'll come round to using Hertz as automatically as now we use amp volt, ohm, henry, farad and all the rest

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In response to many requests, we have completed the development of a transmitter which will meet the need of amateurs who wish to go to SSB but who have hesitated to do so because of a lack of sufficient information on the construction of suitable equipment.

To give readers some idea of what to expect, here is a brief specification:

1. *Fully transistorised exciter.*
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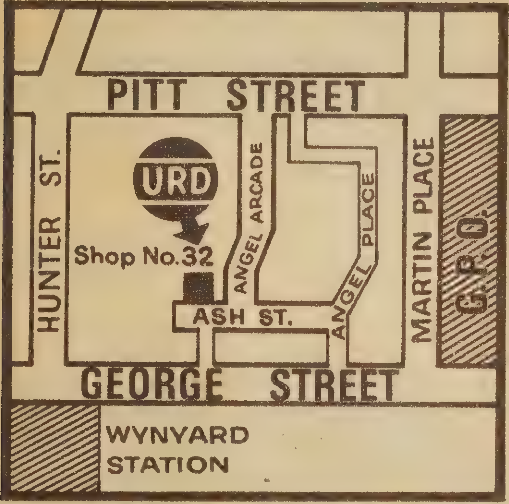
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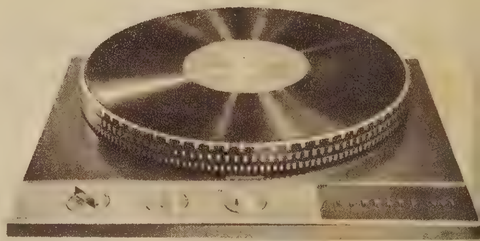

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machine cut strobe, neon lam
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For the critical user . . . offers automatic playing, with pusher-platform, and many other features.

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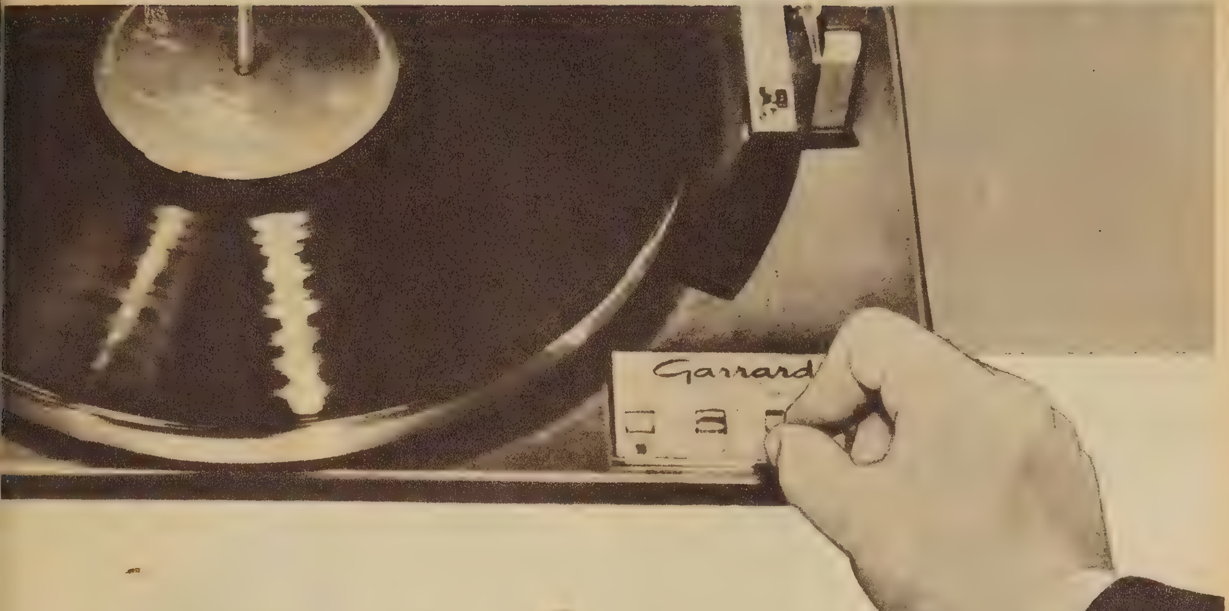

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An outstanding automatic transcription turntable for professional reproduction.

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Single record player with precision arm, heavy turntable, and cueing device.

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Automatic record changer with large turntable, weight-counterbalanced arm and plug-in pick-up head.

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Goodmans Audiom range of loudspeakers have proved their outstanding reliability in constant use in large numbers under the most punishing conditions.

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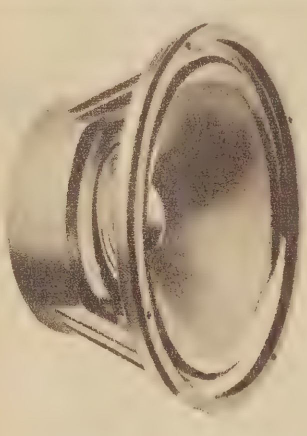

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(12"—15 watts—15 ohms)

Single diaphragm 12" Loudspeaker of rugged design. Pure plastic roll suspension, long-throw aluminium voice coil, robust FEROBA II magnet system. New diecast chassis of open construction and high rigidity. Ask for the Bass version for High Fidelity (with Midax and Trebax); Standard version for Musical Instrument amplification. Public Address work. Not for use with Bass Guitars.

Specification

Fundamental resonance
Bass for Hi-Fi 35 c/s
Std. for P.A. 50 c/s
Power .... 15 watts (30 watts USA)
Impedance .... 15 ohms
Overall diameter .... $12\frac{5}{8}$" (32.1 cm)
Nett weight .... 10 lbs 13 ozs (4.91 kg)

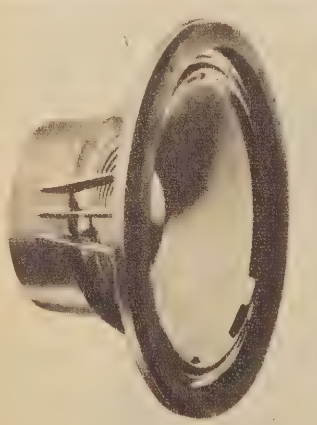
AUDIOM 61

(12"—20 watts—15 ohms)

Very robust 12" single diaphragm Loudspeaker, tough and reliable. Pure plastic roll suspension, long-throw voice coil, rugged FEROBA II magnet system. New pressure diecast chassis of open design and high rigidity. For High Fidelity (with Midax and Trebax) ask for the Bass version. For Electric Guitar and Public Address work ask for the Standard version.

Specification

Fundamental resonance
Bass for Hi-Fi 35 c/s
Std. for P.A. 50 c/s
Power .... 20 watts (40 watts USA)
Impedance .... 15 ohms
Overall diameter .... $12\frac{5}{8}$" (32.1 cm)
Nett weight .... 17 lbs 4ozs (7.82 kg)



AUDIOM 81

(15"—25 watts—15 ohms)

Rugged 15" single diaphragm unit of heavy duty construction with 25 watts handling. Massive FEROBA II magnet system, 3" voice coil, rigid diecast chassis, all plastic cone edge. Binding posts. Ideal for higher powered High Fidelity systems (with Midax and Trebax) — ask for Bass version. For Musical Instrument amplification and Public Address work ask for Standard version.

Specification

Fundamental resonance
Bass for Hi-Fi 30 c/s
Std. for P.A. 60 c/s
Power .... 25 watts (50 watts USA)
Impedance .... 15 ohms
Overall diameter .... $15\frac{1}{16}$" (38.2 cm)
Nett weight .... 22 lbs 8 ozs (10.21 kg)

AUDIOM 91/100

(100 watts British, 200 watts U.S.A.)

A special version of the Audiom 91 with the ability to handle 100 watts of power (200 watts U.S.A.) with reliability and precision.

AUDIOM 91

AUDIOM 91 Bass — For use in very high-powered High Fidelity systems (cinemas, concert halls, etc.) and for specialised demands, e.g. Electronic Organs. AUDIOM 91 Standard—for use with Bass; Guitars, very high-powered Public Address systems and all sound reproducing systems demanding high efficiency and rugged reliability.

Enormously robust 18" single diaphragm heavy duty loudspeaker of massive construction. Exceptionally strong FEROBA II magnet system. 3" voice coil. Rigid cast chassis to endure punishing conditions. Insulated binding posts.

Specification

Fundamental resonance (Bass) .... 30 c/s
(Standard for Bass Guitars and P.A.) .... 55 c/s
Power .... 50 watts (100 watts USA)
Impedance .... 15 ohms
Overall diameter .... $18\frac{1}{16}$" (45.89 cm)
Nett weight .... 22 lbs (9.98 kg)

For Electrical Instrument Amplification. Public Address. Specialised Applications.

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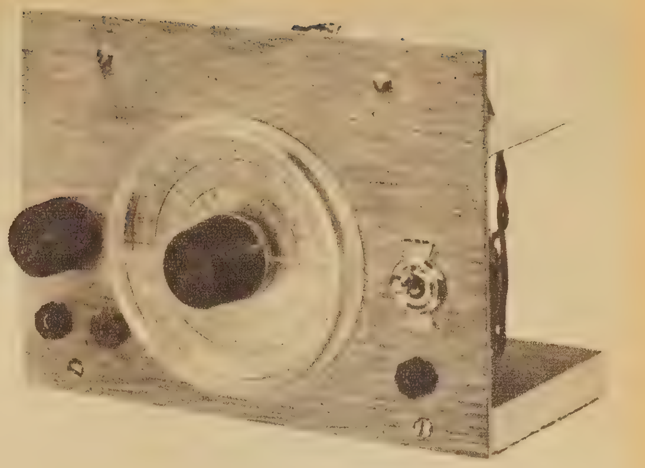


This little receiver should have an appeal to beginners, experimenters and more experienced readers alike. It is economical, exhibits high sensitivity and represents a quite novel approach. It may be used as it is, or it could be the basis for further development and experiment.

By Ian Pogson

Just a week prior to the time of writing, we were looking through the October, 1966 issue of "Wireless World" and came across a short article by G. W. Short. In it, the author described a four-transistor TRF receiver using only one tuned circuit and designed to operate from selenium photo cells, at about 1.3 volts.

To say the least, we were fascinated by the circuit concept. As the writer pointed out, the receiver was meant for the use and amusement of small children. Selenium cells were chosen for the power supply, because they operate from sunlight and it would not matter at all if the young owner forgot to switch it off. In addition, operation had to be as simple as possible and this amounted to a tuning dial and a volume control in the original set.

We duly decided to make up one of these little sets and see for ourselves. The idea of using selenium cells was discarded, however, mainly on the score of cost. Many dry cells could be bought for the cost of the selenium cells.

As no constructional details were given, we elected to make it up in the way we imagined that a schoolboy would do. So we started out with a piece of ½-in thick board for a base, to which was added a front panel made of thin plywood.

A word of warning was issued by the "Wireless World" writer to the effect that the receiver had quite a lot of gain and that, unless the ferrite aerial rod was either kept well away or screened from the rest of the receiver, instability would be a likely problem.

Noting the warning, we made a rough mock-up of the circuit in such a way that we could move the rod around with respect to the RF amplifier system. This made it possible to check the need for—and the effectiveness of — a suitable screen. The screen was indeed necessary but the layout, as shown in our model, proved to be both simple and effective.

Before proceeding with constructional details, let us have a look at the circuit. As mentioned previously, there is only one tuned circuit, involving a coil wound on a ferrite aerial rod. This has a high intrinsic "Q," providing a reasonable amount of selectivity in its own right. There is a second winding on the rod to feed the signal to the base of the first transistor, this winding having deliberately few turns, to minimise loading on the tuned circuit.

Immediately following, are three transistors constituting a direct-coupled, wide-band RF amplifier system. Circuitwise, this is about the simplest arrangement that could be conceived. It gives high gain and at the same time, avoids the need for additional tuned circuits.

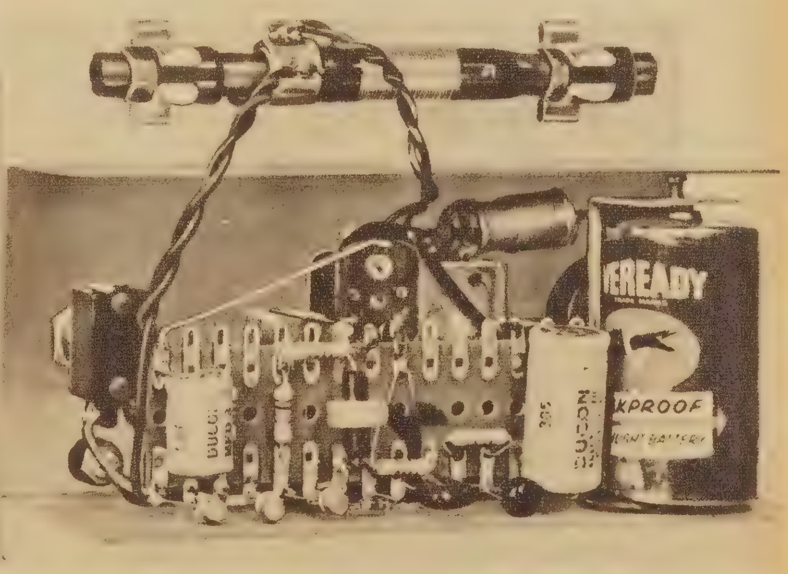
The three transistors used in our prototype are the silicon planar type BF115, which are readily obtainable at quite low cost. We have not tried other types but it is more than likely that other NPN silicon planar transistors would be satisfactory. Among these would be the BC108, 2N3565, SE1001, etc.

It should be noted that the BF115 has a shield connection, effectively earthing the metal cap; most other types do not include this protection. In addition, the BC108 has higher gain than the BF115 and this, along with the lack of shielding, could lead to instability. However, if the builder is inclined to try other types, by all means do so.

In the collector circuit of the third transistor, is a 330-ohm resistor and an RF choke in series. We found it necessary to shunt the RF choke with a 1K resistor to ensure stability of the RF amplifiers. This was not shown in the "Wireless World" circuit and it could be that the transistors which they were using were of somewhat lower gain.

Between the junction of the 330-ohm resistor and the RF choke, is a 100K pre-set potentiometer, the other end of which goes to earth. The rotor picks off the correct amount of bias for the base of the first transistor and enables suitable operating conditions to be set up for all three directly coupled RF amplifiers.

The detector is a germanium diode and almost any type would do in this position. The diode is forward biased by connecting it directly to the collector of the third transistor. This arrangement means that the load resistance should fall between the values of 25K and 100K and for this reason a 50K volume con-



At the top of the page is a front view of our little set and it can be seen that it is simple to operate. Immediately above is a rear view. This shows quite clearly the disposition of most of the components. We suggest that the shield and front panel be made slightly higher to give more clearance for the battery clamp and the aerial rod.

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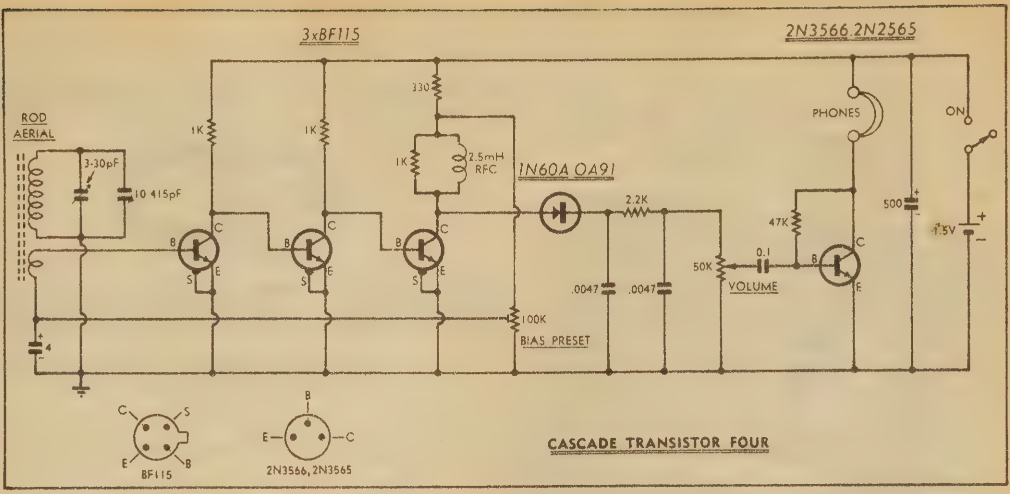

From this circuit will be noticed immediately the rather unconventional arrangement of the three RF transistors in a direct-coupled ascade configuration, which is effective and very economical in erms of wiring and other components.

rol has been specified. We advise that his value be used.

Immediately following the detector is n RF filter, consisting of two .0047uF apacitors and a 2.2K resistor.

The fourth transistor is the audio mplifier, the signal being fed to its ase via a 0.1uF capacitor from the otor of the volume control. Forward ias is provided by the 47K resistor. pair of headphones is connected beween the positive line and the collector f the audio amplifier.

The transistor which we used here s a 2N3566, a type which happened o be handy. The application is not a ritical one and we could have used a N3565 or a BC108, just as effectively. n fact, the requirements are such that lmost any type similar to those menioned could be used.

The "power supply" is a humble 1.5 olt dry cell and perhaps the most conenient type to use is the 915. Across he 1.5 volt supply is a 500uF elecrolytic capacitor, which becomes useful vhen the cell begins to run down. The otal current, as we measured it, is a nere 4.5 milliamps. With this drain, a 15 cell should last quite a long time.

A few general observations should rove useful to readers. As already menioned, certain precautions must be taken o make sure that the unit will be stable. he main one is that the aerial rod ust be isolated from the wide-band F amplifier. This is covered in the etails on construction.

The actual type of aerial rod assembly ill have a definite bearing on the perormance. The assembly shown in the hotograph is one which is readily availble but has been modified to suit our urpose. When purchased, the rod was in long, which was somewhat longer han could be accommodated in this little et. We shortened the rod to 5in, although could have been left as long as 6in. hortening the rod does slightly reduce s directivity but it also reduces inducance. The latter can be corrected by dding a few turns to the coil and this oint will be dealt with later on.

We also tried a Japanese replacement erial rod assembly, which is quite small y comparison, being only 2½in long. Vhen compared for performance with he longer rod, the small one seemed to ave almost as much pickup, but the electivity and null from the ends, was not as good. Unless space is at a premium, it would seem that there is a good case for the larger rod.

Before leaving the subject of the aerial rod assembly, there is another important point which should not be overlooked. The rod must be kept away from metal, particularly ferrous, otherwise the "Q" of the coil will be seriously reduced, resulting in loss of selectivity. More will be said about this under constructional details.

Needless to say, such a modest receiver is only intended to operate a pair of headphones. Crystal headphones are not suitable for this application. Magnetic headphones come in a wide variety of impedance values, perhaps 2000 ohms being the most common. It will be found that these are quite satisfactory and even 4000 ohm types will work but with somewhat reduced sensitivity. The most successful headphones from a sensitivity point of view are the low impedance variety which was so common on the disposals market a few years ago. The resistance of the pair which we used is 25 ohms and these gave excellent results.

We were also hopeful enough to try a small loudspeaker and with reservations, it gave acceptable volume. A 4in speaker with a voice coil impedence of 33 ohms was found to be quite good giving sufficient volume for a quiet room. On the other hand, as the voice coil impedance is reduced, so does the output fall accordingly. At 2 ohms, the output had dropped to a level which could not be considered usable.

The idea of using a transformer to provide a better match between the audio transistor collector and the speaker was also tried. Although from a theoretical point of view, we were able to obtain a fairly reasonable match, results were not encouraging. It would seem that the efficiency and DC resistance of the transformer was such that the improvement in matching was more than offset by the losses. However, interested experimenters could pursue this idea further, if they feel so inclined.

A good idea of the construction may be obtained from the pictures and the wiring diagram. The base board, 6in x 2¾in x ½in, accommodates the variable capacitor, wiring board and dry cell. The front panel is used to mount the On/Off switch, volume control, headphone sockets, dial assembly and aerial rod assembly.

The panel measures 6in x 4¼in x 3/32in thick. It was made of three-ply wood but any suitable material could be used, such as hardboard or bakelite. We would suggest that you increase the height of your panel to at least 4¾in, to give more space under the shield for the dry cell and to permit slightly increased spacing of the aerial rod above the shield.

The shield just mentioned, consists of an "L" shape piece of tinplate. Allowing sufficient clearance for the dry cell, the shield should measure 6in wide, 3-3/8in to the bend and with a 2in fold at the top. We used tinplate, but some may prefer aluminium.

The front panel is screwed to the baseboard with a couple of wood screws, the

PARTS LIST

1 Aerial rod assembly (see text).
2 Clips for aerial rod.
1 On/off toggle switch.
2 Banana sockets.
1 Dry cell, type 915.
3 Transistors, type BF115.
1 Transistor, type 2N3566, BC108, 2N3565, etc.
1 Diode, type OA91, 1N60A, etc.
1 RF choke, 2.5mH.
1 Knob.
1 Dial and scale.

RESISTORS

¼ watt, 10 per cent tolerance.
1 330 ohms.
3 1K.
1 2.2K.
1 47K.
1 100K preset potentiometer.
1 50K logarithmic potentiometer.

CAPACITORS

1 10-415pF variable.
1 3-30pF trimmer.
2 .0047uF low voltage plastic or ceramic.
1 0.1uF low voltage plastic.
1 4uF low voltage electrolytic.
1 500uF low voltage electrolytic.

SUNDRIES

Wood for base and front panel, Tinplate for shield. Aluminium for battery clamp. Hook-up wire, solder, screws.

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shield being clamped behind the front panel and held in place by the same two screws. Holes for the variable capacitor spindle, switch, volume control and headphone sockets, are drilled through the panel and shield and the clamping effect of the bushes helps to make the assembly more rigid. The banana socket on the right was originally fitted for an earth connection but it is not necesary in practice.

The aerial rod assembly is mounted on the front panel by means of two spring clamps which are obtainable at good hardware stores. The clamps must not, in any circumstances, form a shorted turn around the rod.

The aerial rod which we used, measures 3/8in diameter and the clamps are nominally ¼in. You may be able to get 3/8in clamps or do as we did—namely wrap sufficient insulation tape around the rod to increase its diameter to ¼in. This has the advantage of providing some cushioning of the rod against stress. Finally, as suggested earlier, the rod and clamps should be mounted as close to the top of the front panel as possible, clearing the shield by the maximum amount.

The variable capacitor is fixed to the base-board with small wood screws. Due to the thickness of the front panel and shield combined, the spindle of the Roblan variable capacitor may not be quite long enough. This can be remedied by reversing the front mounting foot, turning it under the capacitor assembly, and allowing the capacitor to be mounted closer to the front panel. Only one screw hole of the front foot will be accessible but three screws are quite enough to hold the capacitor down firmly.

The dry cell is held in position by a small clamp fashioned from a piece of scrap aluminium. The sketch shows how it is made. A hole in the foot is drilled for a wood screw, which holds the clamp to the base board. A solder lug, fitted under the screw, provides for the positive lead from the cell to the switch. A self-tapping screw is screwed into the turnover at the top in such a position that the screw makes contact with the positive cap of the cell. Into the base-board, central with the cell position, is screwed another wood screw, also holding a solder lug. The cell sits over the head of the screw and the lug becomes the negative connection from the cell to the earth line.

A miniature tagboard, with 13 pairs of tags is used as a base for the general wiring. Our board has 15 pairs of tags, as can be seen from the picture but the two at the extreme right are not used. Reference to the wiring diagram shows clearly where all the components are mounted and very little explanation should be needed.

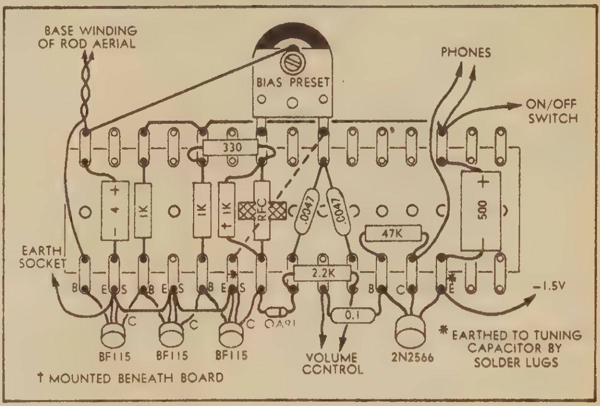
It is a good idea to wire in all the resistors, capacitors and the RF choke first. The detector diode and the four transistors are then soldered in and the usual care should be taken not to overheat these items.

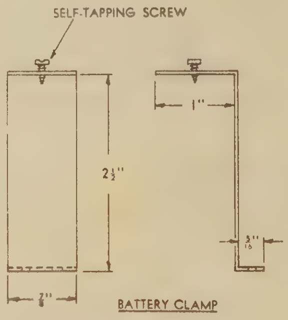
The tag-board assembly may be put aside for the moment and the aerial rod assembly readied for use. Just how this item is dealt with, depends upon the type of assembly which you decide to buy.

One which is readily available is that distributed by Messrs Watkin Wynne. It is not suitable for our purpose, as purchased, and modifications must be made. The rod is 8in long and it needs to be shortened to 6in or thereabouts. Before this is done, the coil should be slid off the rod.

Where the rod is to be cut at the 6in point, run a file around the rod and cut a shallow groove. Now hold the rod in a vyce with the groove just clear of the jaws. Do not tighten the vyce too much, or you may crack the rod at another place. The surplus rod may be knocked off with a sharp tap from a hammer. The break may not be straight but this does not matter.

This wiring diagram makes the task an easy one and it should be followed if the original layout is to be adopted. Note particularly, the earth lugs.





This is how we made our battery clamp. Readers may be able to think up other ways of doing the same job.

The coil windings must also be modified but the large tuning winding must be kept intact for the present at least. With a pair of wire cutters, cut off the leads to the lugs marked with the blue and red dots. These leads may be cut right back to the winding but they may be left in this condition. Using the vacated lugs for terminations, wind on four turns of enamelled wire over the end of the main winding and nearest the lugs. The gauge of wire is not critical and anything around 30 gauge will be in order.

This new winding becomes the one for the base circuit of the first transistor. One end goes to the transistor base and the other end goes to the 4uF electrolytic and the pre-set potentiometer. It does not appear to matter which way the connections are made to this winding.

As the rod has been shortened, the inductance of the tuning winding will be slightly reduced. This may be corrected by adding a couple of turns to this winding but we consider that it is not really worth the trouble. There will be a small error in dial calibrations at the low-frequency end of the dial but scarcely enough to worry about.

The winding is slipped back over the rod, with the winding located in the centre. It can be held in place by wrapping a couple of turns of plastic insulation tape over one end of the former, such that the tape also contacts the rod.

If you decide to use one of the miniature aerial rod assemblies, referred to earlier, a different approach will be necessary. Mounting arrangements will need to be changed but the two plastic feet provided will suggest the method to be adopted and we can confidently leave this to the builder. One point only must be stressed—what we said earlier about keeping the rod away from metal objects still applies.

However, there is more to the installation of this little rod than the mounting process. First of all, the four leads will have to be identified. At one end, there is one lead only and this goes to the fixed plates of the variable capacitor. One of the three leads at the other end belongs to this winding and is connected to the rotor plates of the variable capacitor and the earth line. Identification of this lead can best be carried out by using one of the "ohms" ranges on a multimeter.

The remaining two leads on the aerial rod assembly are for the base circuit of the first transistor. One lead will go to the base and the other to the 4uF electrolytic capacitor and the rotor of the 100K pre-set potentiometer. It does not appear to matter which way these leads are connected. If you feel inclined, you can check for yourself.

When the rod is installed and the receiver is working, it may be found that the receiver is tuning to a much lower frequency than the lower limit of the broadcast band. The tuning winding of the assembly, as pictured, had far too many turns for our purpose and presumably it had been wound for use with a much smaller tuning capacitor. Just a few turns at a time should be removed from the end with the one lead. The coil should then be refitted and checked for alignment at the low frequency end of the band. More will be said about adjusting the alignment against the dial scale further along.

With all the components and sub-assemblies now ready, we can now proceed with the final assembly. Mount the variable capacitor on the base-board first. In doing so, place a solder lug

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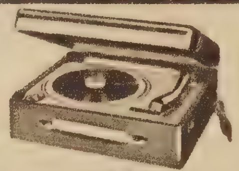

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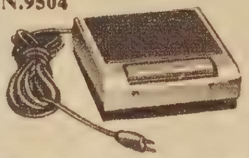

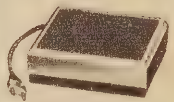

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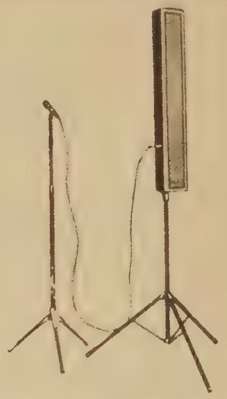

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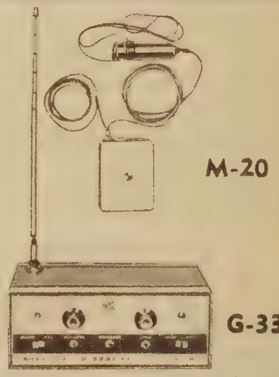

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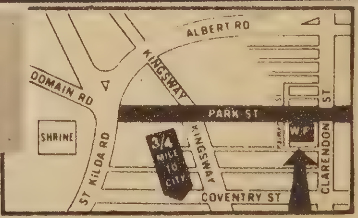

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under each of the two back screws, with the lugs pointing towards the back.

If you have wired the tag board according to the wiring diagram, you will find that the bottom lug at the extreme right and another lug, seven to the left, are earth-line points and will correspond with the lugs on the capacitor mounting feet. The four lugs concerned can be used to solder the tag board assembly into the vertical position as shown in the photograph.

Another solder lug may be screwed to one of the holes at the top back of the variable capacitor frame and this may be used as an earth point for the trimmer and the aerial rod.

The dry cell could now be conveniently fitted into place, by sitting it on the screw on the base-board. The clamp is also screwed into place and the self-tapping screw is tightened on to the top contact of the cell so as to hold it firmly in place.

A picture of the miniature imported aerial rod assembly intended as a replacement unit for miniature transistor portables. See text for details.

Having assembled all the components on the front panel and metal shield, these can now be screwed on to the base-board. Interconnecting leads between the various components will virtually finish the construction work. If you use the same sort of dial and scale as we did, the scale should be carefully stuck on the front panel and the dial pushed over the tuning capacitor spindle. With the capacitor fully meshed, the line on the dial should be horizontal.

Before switching on, the big moment should be delayed and a check should be made to ensure that there are no wiring errors.

Having satisfied yourself that all is well, plug a pair of headphones into the appropriate sockets and adjust the 100K pre-set potentiometer so that the rotor is at the earthy end. Now set the dial so that it points to a local station frequency and turn up the volume control. Switch on but do not expect to hear a signal at this stage.

With a screwdriver in the slot of the pre-set potentiometer, advance the rotor slowly, adjusting the tuning as necessary, until a signal is heard; do not advance the rotor further for the moment. If the signal is a loud one, turn down the volume control until the volume is at a comfortable but fairly low level. Return to the screwdriver adjustment and make slight alterations until the audio is clean and not distorted.

Do not advance the rotor more than necessary for good results, as it tends to reduce selectivity. It should be possible now to tune around the dial and get whatever stations may be within range.

The stations, one toward each end of the dial if possible, should be checked for correct calibration. The trimmer across the tuning capacitor should be adjusted to bring the station in at the correct point at the high frequency end of the dial. Now check the station nearest the low frequency end. If this is not correct, then the easiest way to bring it into line is to move the dial slightly on the capacitor spindle. The alternative to this is to add a turn or two to the tuning winding on the aerial rod but, as we said before, this may not be considered worth the trouble.

If it was necessary to make this adjustment, then it will be necessary to go back to the other end and re-adjust the trimmer to bring the high frequency station into line. The process must be repeated at the other end and any adjustment should be made.

Referring back to the miniature aerial rod assembly and our earlier remarks. If you are using one of these, a few turns should be removed and the calibrations checked at the low frequency end. This should be carried on until the station concerned is getting close to the correct spot. It would be wise then to adjust for the station at the high frequency end, with the trimmer as described above. If it is necessary to remove any more turns at this stage, then it should be done one turn at a time.

With the receiver now in working condition, a little experimenting will be well worthwhile. The directional properties of the aerial can be used to advantage, by turning the whole set around until weak stations are heard at best strength. On the other hand, if you happen to be close to a broadcast station, then it may be necessary to turn the set so that one end is pointing toward the transmitter; this will reduce the pickup to a minimum.

There are often cases where there are a number of stations audible and the stronger ones may interfere with the weaker ones. By careful rotation of the set, it is often possible to reduce the strength of an interfering station and so get good reception from a weaker one.

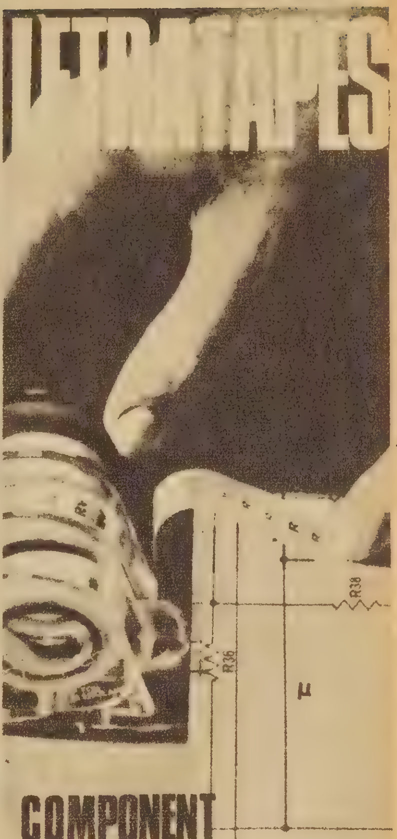
Reception conditions in our laboratory on the twelfth floor of a steel and concrete building in the heart of the city, are notoriously poor. However, by resorting to the technique of rotating the set into the most favourable position, we were able to receive the eight local stations.

The writer also took it home to Epping, which is a northern suburb of Sydney and about 11 miles from the city. Two commercial stations, 2CH and 2SM, are located only about three miles away. The other four commercials, 2GB, 2UE, 2KY and 2UW are all in the Homebush area some seven miles away. The ABC transmitters are at Liverpool, something like 15 miles away.

All stations could be tuned in loud and clear but in some instances, the two closest stations caused quite a bit of interference but ths could be remedied by the rotating technique, previously mentioned. Some interference was still evident on some transmissions but could be reduced to such a level that it was not considered troublesome.

The idea of adding an extra stage of audio amplification has already been suggested. This appears to be an attractive proposition but we have not pursued this idea up to the present time. However, we hope to be able to do some work on this and any other possible refinements which could be added, at some future date.

And so there it is. Go to it and have some fun with this novel little receiver! ◘



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A POWER SUPPLY UNIT FOR TRANSISTORS

With the advent of transistorised equipment, a great deal of attention has been focused on suitable low-voltage power supply units, in many cases featuring variable voltage and overload protection The following description of such a power unit has been supplied by Mr C. Horwitz, of 81 Prospect Rd., Summer Hill, N.S.W.

Mr Horwitz writes:

"My design is for a transistor power upply. There are many such designs round, but none of them seemed to satisfy my needs, namely: (1) Inexpensive overload protection, (2) output o 25 volts at 1A, easily modified o higher ratings when needed, and 3) moderate cost.

"This power supply meets the requirements very well and is satisfying o use, because of the facilities it offers.

"Basic to the supply is the voltage egulating action; this is standard and description of its operation can be ound in a number of places, including he 'Basic Radio Course.'

"The difference is that my own egulator has two voltage reference ources to obtain the widest range ossible of output voltage.

"In the unit constructed, the 9V ener gave a range of 9-25V and, by he nature of the section, this voltage ould not be reduced. As lower voltages han 9V are often needed, a forward-iased silicon diode was added to make new range of .75V-12V, providing quite a low minimum voltage, with a easonable overlap of voltage at high nd.

"When low voltage is selected, and high current drawn, the transistor could have almost the full voltage across it, and thus would dissipate a large amount of power, requiring a big heat-sink. To avoid this situation, a 10-ohm resistor has been incorporated so that, when the unit is delivering low voltage, the resistor is in series with the supply, thus reducing dissipation within the power transistor.

"The variable current cutoff circuit is interesting, for it provides reliable cutoff over a wide range, without the need for an additional high-power transistor, which would unduly raise the unit's cost.

"This is achieved in the following manner: TR3 is reverse-biased by a voltage picked off from the 10K spot. This voltage is counteracted by the voltage across the 50-ohm or 3-ohm resistor, caused by current through the load. When the load current is such that the offset voltage is a little greater than the reverse voltage on the pot, TR3 draws current through the 300-ohm resistor, thus decreasing the bias on TR1, and so decreasing the voltage at the load.

"The zener diode across the 10K pot is for calibration purposes; above 9V, the zener keeps a constant voltage across the pot, thus enabling calibration of cut-off current points on the front panel. However, this feature may not be wanted, and in that case, simply omit the zener.

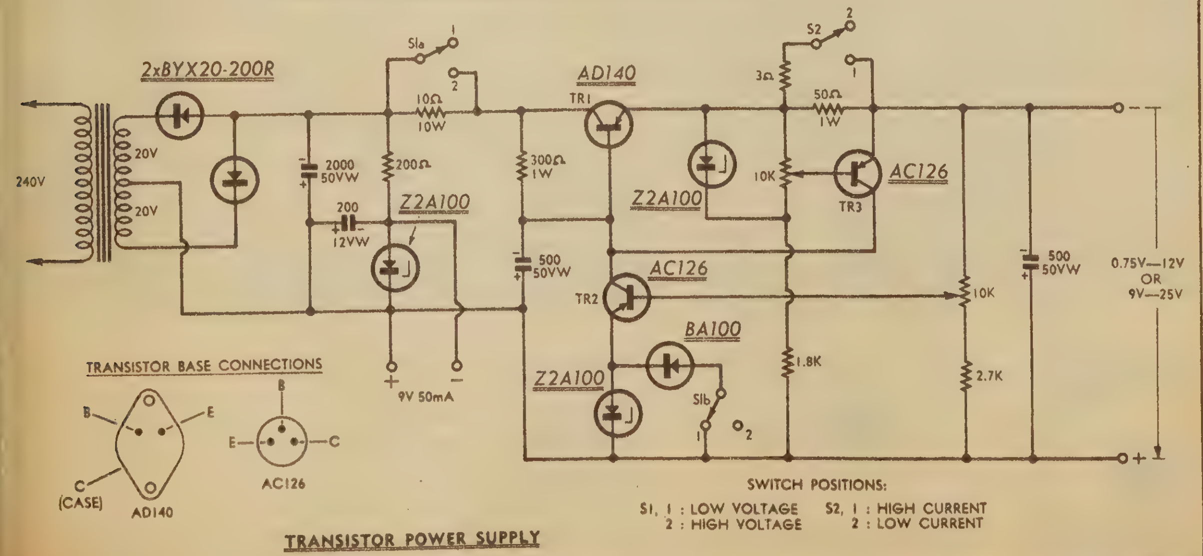
"It is quite easy to operate the control without the zener. When the load is inserted the pot can be turned to just give the maximum voltage indicated by the voltage selector pot. Then, if any more current is drawn by the load, the voltage will immediately diminish.

"The supplementary power supply consisting of a 9V zener, resistor, and capacitor, is very useful when two different voltages are needed for equipments operating simultaneously.

"The resistor values given are for a 25V, 1A supply. If it is required to extend the current to 2A, the following changes should be made: the 300-ohm resistor should be changed to 150 ohms; another cutoff-circuit resistor, 1.5 ohms, should be added, and the 10-ohm resistor should be halved.

"Also—and this is a very important point — the heat-sink for the transistor should be made large, as the increased dissipation could overheat and ruin it.

"The unit constructed was tried out on a 40V input, and it performed quite well in giving 1A, but as a new and much higher-powered transistor would have to be used to supply 40V at 2A, I did not try out the higher current.



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5D7MS	3600' .48 Mil Polyester	15.90	7.95
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15D5	600' 1.5 Mil Acetate	$3.60	$1.80
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10D5M	900' 1.0 Mil Polyester	5.32	2.66
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	ON 5½" REELS		
15D57	800' 1.5 Mil Acetate	$4.66	$2.33
10D57	1200' 1.0 Mil Acetate	5.10	2.55
10D57M	1200' 1.0 Mil Polyester	6.66	3.33
5D57M	1600' .5 Mil Polyester	5.98	2.99
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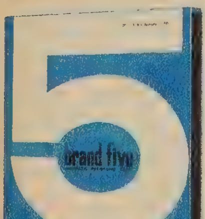

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“If it is desired to operate the unit t 40V, the 300-ohm and 200-ohm esistors should both be doubled.

“For operation at 25V 1A, the ower transistor was mounted on a in x 6in piece of aluminium, with o mica, and with silicone grease.

“The complete unit, except for the igh-power components, was mounted n a piece of sample ‘Veroboard,’ naking a very compact unit feasible. he cutoff-circuit resistor was made from a piece of toaster wire, but I suppose that a suitable resistor could be bought.

“I have made no provision for metering, as it is up to the individual to decide whether to use his multimeter or a fully switched metering system.

“I have used the supply for some time now, and I expect that everyone who makes it will be as satisfied as I am with its performance.”

AN EXPANDED SCALE VOLTMETER

From a reader in New Zealand comes a letter on the subject of expanded scale voltmeters, based on electronic rather than mechanical principles. The contributor, in this case, is Mr D. C. Harvey (ZL1BR) P.O. Box 146, Waihi, N.Z.

“A little more than a year ago (Augst, 1965), Keith Jeffcoat wrote an artcle in ‘Electronics Australia’ on the adantages of using expanded scale voltneters to check the condition of the amily car battery. While this article vas very enlightening, I must disagree vith his contention that an electrically xpanded scale would be more expensive nd difficult to calibrate than the mechnically expanded type. The following aragraphs will illustrate my point.

“I had forgotten this article when a ew idle moments ‘doodling’ (thinking on aper) brought the idea to mind again. Half an hour and several sheets of paper ater, the accompanying circuit was proluced.

“An advantage of this circuit is that nost of the required components can be ound in a well-stocked spare parts shop. he operation is as follows:

“Assume R3 to be set at 100 ohms. variable DC supply is connected to he input terminals and slowly turned p from zero. The voltage at ‘A’ rises ositively with respect to the negative rminal, just below the applied voltage t the positive terminal. There is a nall voltage drop across R1 since a nall current flows through R4 and R2.

“The potential at ‘B’ rises positively ccording to

$$\frac{R2}{R2 + R3} \times E \text{ applied.}$$

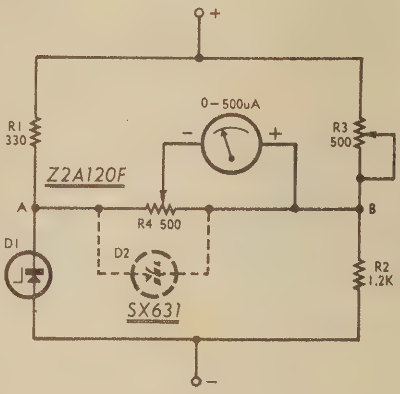
“The meter will be observed to deflect ownward to begin with, since the voltge at A rises more readily than at B. t 12V input, the zener diode begins conduct and, as the input is increased rther, point A remains at +12V, while e voltage at B continues to increase.

“At 13V input, the potential at A is 12V and at B is

$$\frac{1200}{1200 + 100} \times 13$$
$$= 12V$$

“Thus, there is no voltage across R4 d the meter reads zero. Thus, we ve a balanced bridge condition, with zero meter reading at 13V input.

“Full-scale deflection will depend upon sensitivity of the meter and the setg of R4. For a full-scale deflection 15V input, for example, using a 500uA movement, it was found that was set so that 39 ohms was shunted ross the meter and approximately 460 ms in series.



“Diode D2 is included if necessary to limit the reverse deflection when the input voltage drops below the zener voltage. This diode should have a low forward resistance, where the voltage required for zero reading is somewhat higher than the zener voltage. A Mullard SX631 was used in the prototype, but a discarded flat transistor has also been used successfully, tying base and collector together.

“It is obvious from the foregoing that, within limits, any desired minimum and maximum voltage can be selected at will, merely by adjusting R3 and R4 or by switching in suitable fixed resistors.

“Zener diode D1 is the heart of the circuit and while almost any type will suffice a 5 per cent tolerance is recommended for reasonable accuracy. The diode used in the prototype is an S.T.C. type Z2A120F, a 12V, 1W unit. Other suitable types are Mullard SZ12C for 12V minimum and S.T.C. Z2A91F, Mullard SZ91A, or OAZ207 for 9.1V minimum. Higher or lower voltage ratings can be used as well, depending on the required minimum voltage to be measured.

“Power rating is relatively unimportant, since the value of R1, the current limiting resistor, can be selected to suit, for example, a 9.1V diode rated at 260mW (OAZ207) can be used up to a maximum zener current

$$I=P/E=.26/9.1$$

or 29mA approximately.

“If the maximum voltage to be measured is 15V, then

$$R1=E/I=15/.029=516$$

“A 560-ohm resistor is a good choice in this case, since it allows a safety factor for the diode, but is not high enough to affect regulation.

“It is interesting to note that when R3=0, the meter starts to indicate at the zener voltage. In this case, no backward movement occurs, since the voltages at points A and B rise at the same rate. The bottom of the scale is slightly non-linear, however, and, if R3 is set so that zero meter indication occurs at 0.5V or more above the zener voltage, the entire scale will be almost perfectly linear.

“This means that calibration is simply a matter of checking zero and full-scale readings and interpolating the intermediate points on a linear basis.

“The prototype was calibrated against a VTVM of known accuracy and having a 7in scale. This allowed as much readout accuracy as is necessary for practical purposes.

“The meter movement can be any moving coil type from 50uA to several milliamps F S D, thus allowing the use of cheap but rugged surplus types.

“All components were mounted on a printed circuit board, which bolted on to the meter terminals, making a very compact assembly. However, wiring is not at all critical.

“For stability R3 and R4 should be replaced by fixed resistors. To obtain the correct values, start with standard values slightly higher than required and pad down with much higher values in parallel. In this way, good accuracy can be achieved using junk-box parts.

“The accuracy of the prototype constructed and calibrated as stated was approximately 3 per cent and the cost less than $4. This is far below the price of a commercially built expanded scale instrument and the added versatility more than compensates for the time involved in calibration.”

EDITOR’S NOTE: We reprint Mr Harvey’s contribution, because it draws fresh attention to an idea which other readers may find useful for special applications. For further information on the subject, we would refer readers to two articles by our staff member Ian Pogson, in our issues (then “Radio, Television and Hobbies”) for March and April, 1963. Temperature coefficient problems were discussed, but a practical circuit was presented, along similar lines to the one suggested by Mr Harvey.

The decision to recommend meters with a mechanically suppressed zero, in the subsequent article (August, 1965) was based on the clear statement by two local meter manufacturers that this was the cheapest and simplest way to produce an automotive voltmeter, having the necessary sensitivity, accuracy and temperature stability. In fact, as stated in our article, it involves no extra parts, just a modification to normal assembly and adjustment procedures.

For those who want to use an existing meter, it would certainly be more practical to modify its law electrically, reverting to our April, 1963, circuit. However, it would be the more expensive —and less satisfactory—way to produce a complete meter for sale. A point, which was stressed in our August, 1965, article, is that any meter intended for permanent installation in a car must have bearings capable of withstanding vibration and this would not be true of many ordinary milliammeters. ■

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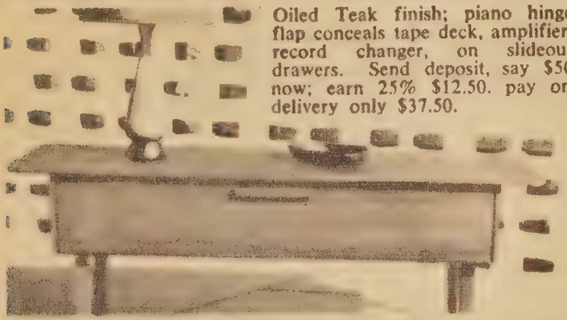

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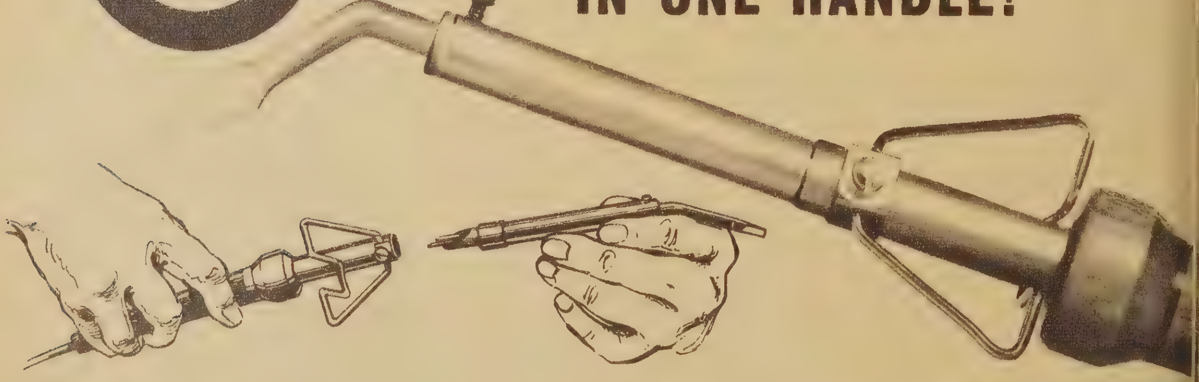

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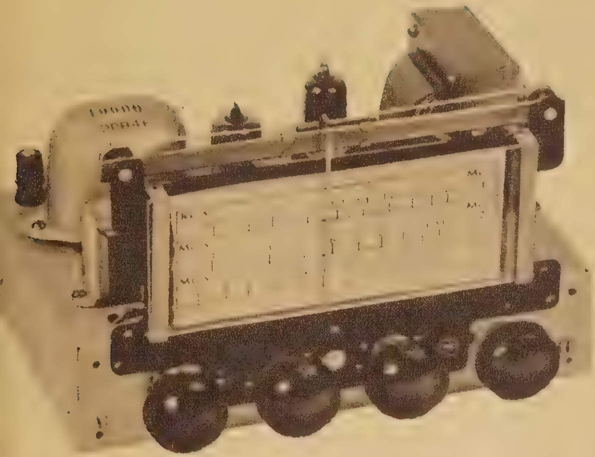
For our younger readers:

THE 3-BAND RECEIVER WITH OUTPUT STAGE

Here is a logical development from our "Three-Band-Two" presented last month. As with the original version, we have added a power output stage, to make it the "Three-Band-Three". Both the added power output and extra gain can be put to good use, particularly where loudspeaker operation is an advantage. Only a few extra components and a little work are needed to make the change.

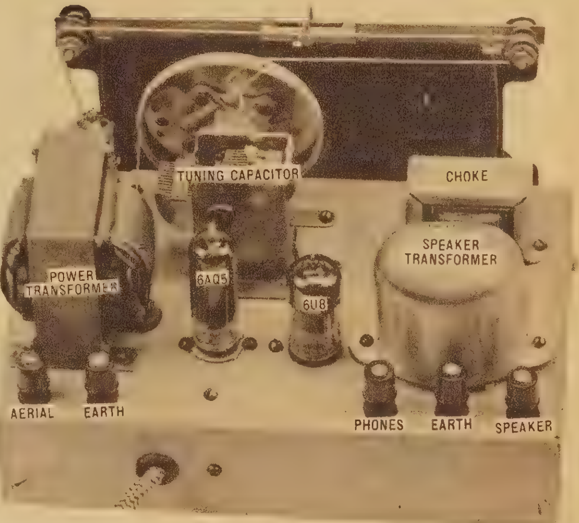


This version of our switched coil receiver was originally presented in August, 1957, following the "Two-Band-Two" version in May of that year. However, the additions are just as valid today as they were then and, more important, are not likely to involve any hard-to-get components. So, if you have already built the "Three-Band-Two," it will be relatively easy to add this portion.

The front end of the receiver remains essentially as before, but the audio stage (6U8 triode) and the power supply need to be modified. The change to the audio stage amounts to converting it from an output stage working into a transformer to an amplifying stage working into a resistive load.

This involves two components. The output transformer primary is disconnected (the transformer itself remains on the chassis) and, in its place, is fitted a 47K resistor. The other component is the cathode resistor, which is increased from 470 ohms to 3300 ohms to suit the new operating conditions.

There are also two main changes to the power supply. First, it is necessary to replace the simple resistive filter network used last month with a more conventional inductive filter, in order that the system can supply the much higher current requirements of the new output stage.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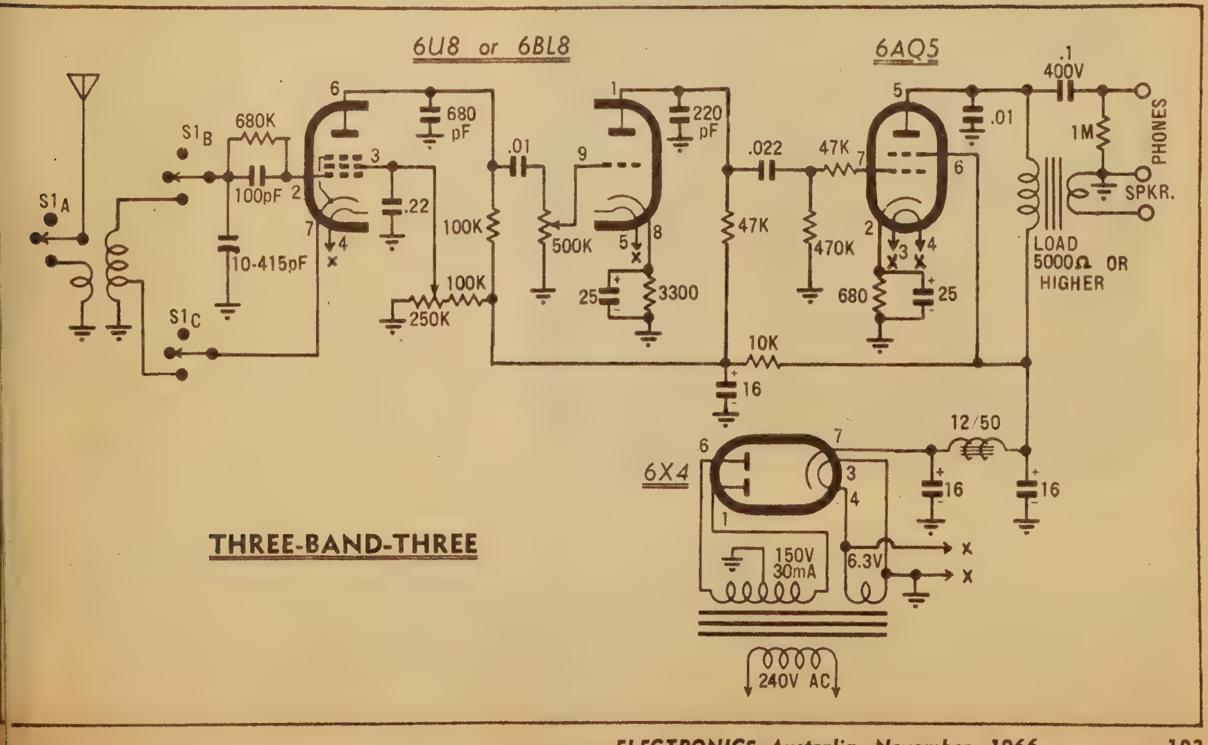
6U8 or 6BL8
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S1A
S1C
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100pF
10-415pF
6
3
2
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4
x
680 pF
.22
100K
100K
250K
.01
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470K
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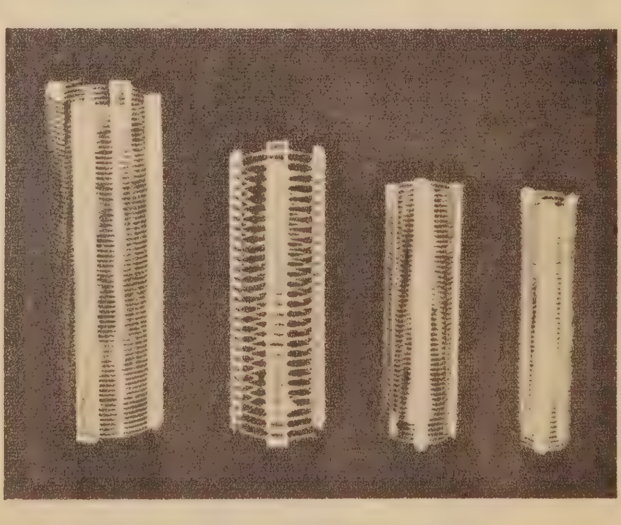

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2-16	5/8in	16	3in	No. 3007	70c
3-08	¾in	8	3in	No. 3010	82c
3-16	¾in	16	3in	No. 3011	82c
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References: A.R.R.L. Handbook, 1961, "QST," March 1959; "Amateur Radio," December 1959.

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In practical terms this means replac- ig the 6800 ohm resistor with a small lter choke, typically a type "12/50" 2 Henries, 50mA) or something simi- ır, the exact type not being particularly ritical. It is mounted above the chassis front of the output transformer.

The other change is to fit a de- oupling network in the HT supply to e first two stages, i.e., both 6U8 sec- ons. This is necessary for two reasons. irst, it provides additional filtering to ese stages, which might otherwise iffer from some hum level, which ould be passed on and amplified by e additional stage.

Secondly, it prevents unwanted coup- ng between the detector stage and the itput stage, via the common power ipply. Due to the quite high overall in of the whole set, such coupling uld give rise to "motor boating" and her forms of instability.

The decoupling network consists of 10K resistor and 16uF electrolytic nnected to the HT line as shown in e circuit.

The output valve socket is accom- odated in the spare hole in the chassis, st behind the tuning capacitor. It ould be orientated so that the gap tween pins 1 and 7 points toward e 6U8 socket. A two terminal tag ip is mounted under the 6U8 socket ounting bolt nearest the 6AQ5 socket, d serves to support the 470K 6AQ5 id resistor. Most of the other 6AQ5 mponents can be supported by their n pigtails between the various termi- l points.

In wiring the output transformer to e new valve socket it is most likely at the existing leads will have to be tended, since they were probably cut ort to suit the 6U8 socket position. dinary hook-up wire can be used, th a short length of plastic sleeving er each joint. The two leads may be isted for neatness.

In last month's article we specified output transformer primary impe- nce of 8000 ohms. This was selected provide the best possible load condi- ns and produce as much power as ssible from the small triode.

With the addition of a more con- itional power output valve, the load uirements become somewhat less tical so that, although the optimum these operating conditions would be und 5500 ohms, the 8000 ohm trans- mer would still function perfectly ll. In fact, almost any single-ended ve-type output transformer from 5000 ns up would be quite satisfactory in imple application like this.

Note, however, that the secondary ding should have a similar nominal edance to the voice coil of the loud- aker which you propose to use. Thus say, a 3-ohm loudspeaker, try to a transformer with a 3-ohm secon- y winding.

lthough the 6AQ5 is a logical choice a small set, and is most likely to available from scrapped receivers, e are other types that could be used. 6AQ5 is really a scaled down sion of the old octal based 6V6 and the same characteristics within its ricted range of absolute maximum ngs.

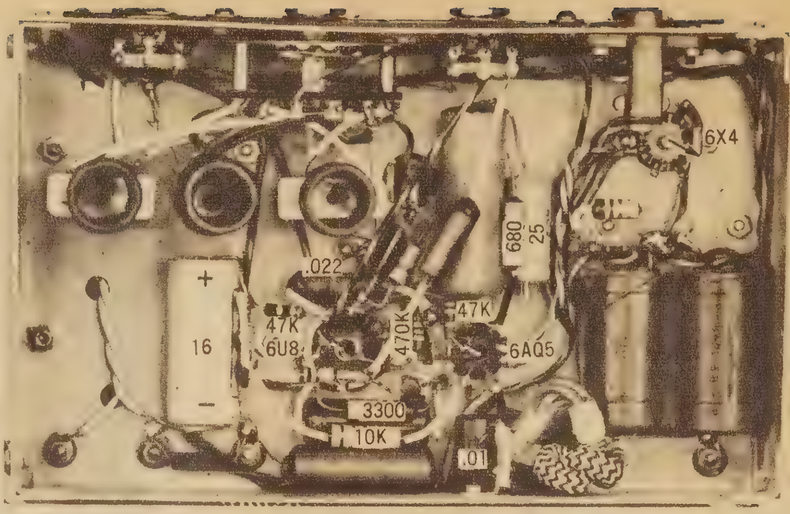
hus, electrically at least, a 6V6 could used without any circuit changes. The n problem would be the purely sical one of accommodating it on and under the chassis. This may call for a little ingenuity, but worth a try if it was all that was available.

Another version of the 6V6 is the 6BW6, which is a 9-pin based valve, larger than the 6AQ5 but considerably smaller that the 6V6. Once again no circuit changes should be necessary.

A possible substitute of a somewhat different type is the 6BV7. This is also a 9-pin base type, and consists of a pentode output valve and a pair of diodes in the one envelope. In this application the diodes can be ignored and the only circuit change required is a cathode bias resistor of 175 ohms in place of the 680 ohms.

Somewhat similar to the pentode section of the 6BV7 is the 6M5, and this would also require a cathode resistor of around 175 ohms. It uses a 9-pin base.

Fairly obviously, the above alternative types will have their own particular pin connections. Space does not permit listing all these arrangements, they are available in standard valve data handbooks. ■



This underchassis photograph shows the additional components used to fit the extra stage. It should be compared with the similiar photograph in last month's article.

PARTS LIST

1 6AQ5 valve
1 7 pin miniature socket
1 50 mA filter choke (12/50 or similiar)

CAPACITORS

1 25uF 10V electrolytic; 1 16uF 350V electrolytic; 1 .01uF 300V; 1 .220pF ceramic or mica.

RESISTORS

(Half-watt unless specified)

1 470K; 2 47K; 10K; 1 680 ohm 1W.

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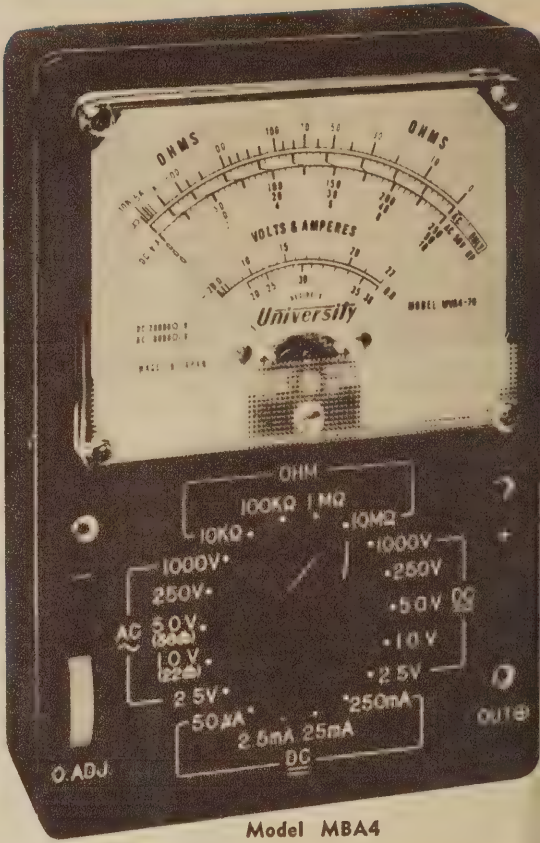

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KEEPING UP WITH semiconductors

. . . Symmetrical Switches

There are a number of silicon bi-ectional or "symmetrical" switching vices which may be regarded as de-opments from the basic PNPN struc-e as used in the four-layer diode and thyristor. Generally these devices nave rather like two PNPN structures nnected in inverse parallel, giving ectively identical operation for either ection of current flow.

Not unexpectedly, their operation de-nds upon the same two general prin-les as with the four-layer diode and yristor: regeneration due to **internal plification** produced by the configura-n of P-N junctions, and the charac-istic dependence of current gain upon rent **level** in silicon devices.

The **Triac** device is a G-E develop-nt which replaces an inverse-parallel ristor pair for AC power control.

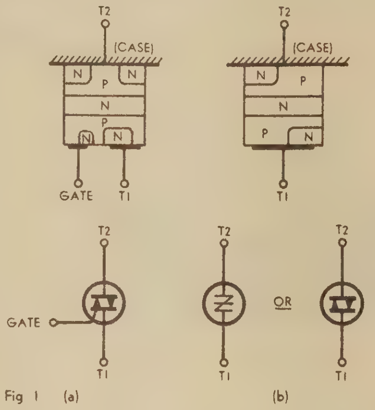
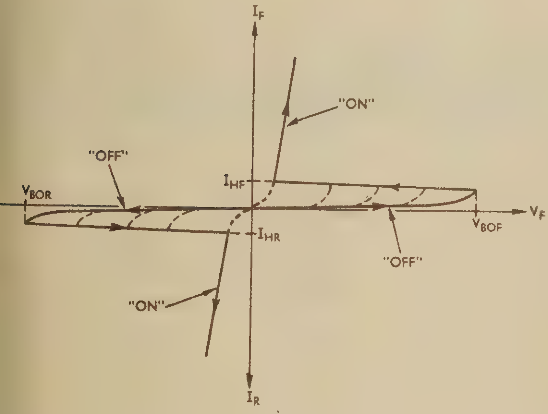


Fig 1 (a) (b)



Above, the pellet structures for the Triac and Sidac devices, together with symbols. At left are shown their characteristics.

e structure of the Triac silicon pellet shown in figure 1(a), together with usual schematic symbol.

Although the exact operation is rather nplex, this structure behaves essen-ly as a thyristor for both directions applied voltage. The single gate ctrode acts as a cathode gate when in electrode T2 is more positive than and as an anode gate when the ap-d voltage is reversed. Once the de-breaks over in either direction, the electrode loses control and conduc-continues until the current drops be-a critical value **Ih.**

ike the thyristor the Triac will turn " in four-layer diode fashion if the lied voltage is increased sufficiently raise leakage current alone to the cal switch-on level. And with the c this can occur in either direction, ing the device inherently self-pro-ing with regard to line transients.

ypical Triac devices have breakover ages at Ig=0 of 400V in both direc-, which figure falls to virtually zero ate current is increased from zero pproximately 100mA at 3V. Maximum current rating for present-day devices is typically 10 amps RMS.

The **Sidac** is an S.T.C. development which is virtually two PNPN diodes in inverse parallel. It thus corresponds to a Triac which lacks the gate electrode. The structure of the Sidac silicon pellet is shown in figure 1(b), together with two alternative schematic symbols.

Whereas with the Triac leakage current switch-on is used almost solely for protection, in the Sidac this mechanism is the **intended** method of control, as with the four-layer diode. When the device is used for AC control, the breakover voltage is arranged to be above the peak mains voltage, switch-on being initiated by means of a sharp pulse superimposed upon the supply by means of a pulse transformer.

The characteristic curve for the Triac with zero gate current is virtually identical with that of the Sidac, as one might expect, and thus both are represented by the solid curve of figure 2. The dashed alternative curves illustrate the behaviour of the Triac for various gate current values.

The **Diac** is a low-power symmetrical diode device developed by G-E and mainly intended as a trigger element for the Triac. It behaves in very similar fashion to the Sidac, although it is actually a three-layer PNP device resembling a symmetrical transistor without a base connection. The breakover voltage is quite low; around 30V in typical devices.

The Diac characteristic and symbol are the same as those for the Sidac.

(J.R.)

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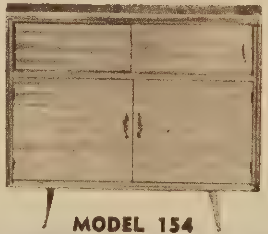

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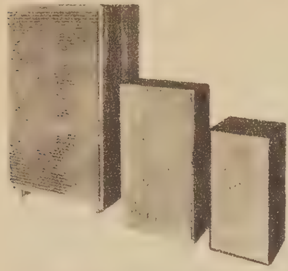

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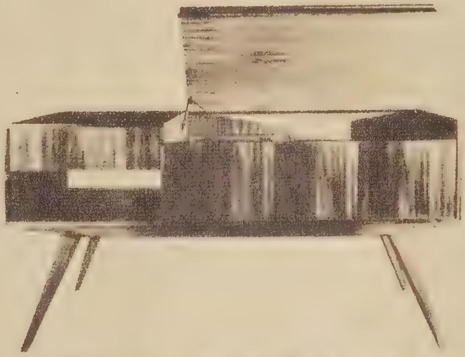

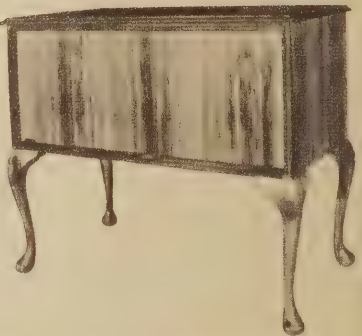

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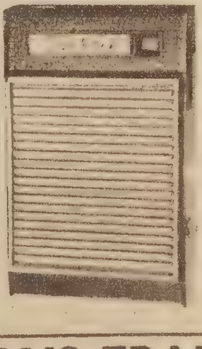

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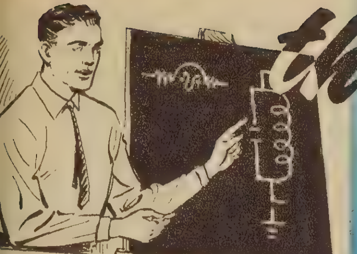


the "Answer Man" Explains

HEAT SINKS FOR VALVES AND TRANSISTORS

Number one question for Answer Man, this month, is on the subject of transistor heat sinks, which we have chosen to extend to cover valves as well. It's one of those subjects which is easy to grasp in principle, but hard to tackle in detail.

I have a general idea of what a heat ink is for. What I would like to know s how one determines when a heat sink s necessary and how big it should be.

To use a much overworked phrase, let's tart at the beginning!

In normal operation, some of the supply nergy fed into valves and transistors is lissipated within the device itself as heat. The actual proportion of the input power o dissipated depends on the device itself nd on the conditions under which it is perating.

Valves used in ordinary receivers and mplifiers dissipate a quite significant mount of power internally and they can ecome quite hot as a result. However, hey are designed to withstand this heatise without undue ill-effect, by the use f carefully selected and processed metals nternally and a glass envelope resistant o softening or cracking.

Valves normally get rid of their heat by atural radiation and convection.

For specialised applications, particurly in transmitters, valves may well be sed under conditions where they generte more heat internally than they can et rid of by natural means. They have be force-cooled by a draught of air om a fan, built into the equipment for e purpose.

For still higher-powered applications, may be impractical to obtain sufficient oling by simply blowing air over the ass envelope and, in this case, the anode ructure is commonly brought out rough a large metal-to-glass seal and ted with copper fins, through which a ast of air can be directed.

A still further method, used for valves ndling very high orders of power, is enclose the exposed portion of the ode in a jacket through which water is mped. By using distilled water and ses with a high insulation resistance, at can be conducted away from the ode structure, without providing an ctrical path to water pump and reserir.

These attachments to valve anodes, air or water cooling, can really be oked upon as "heat sinks," so that term does not apply exclusively to nsistors.

To develop the mental picture created the term, one can consider the fins the jacket as a "sink" into which the heat pours and from which it flows out again, via the air or water stream.

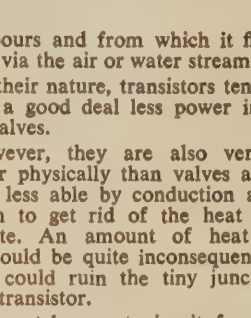
By their nature, transistors tend to dissipate a good deal less power internally than valves.

However, they are also very much smaller physically than valves and, as a result, less able by conduction and convection to get rid of the heat they do generate. An amount of heat energy, that would be quite inconsequential to a valve, could ruin the tiny junctions inside a transistor.

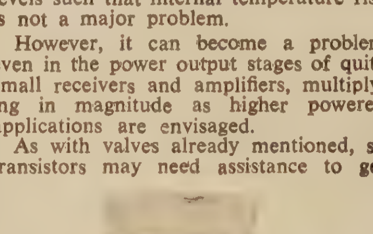
Fortunately, most circuit functions in transistorised equipment can be performed by transistors operating at power levels such that internal temperature rise is not a major problem.

However, it can become a problem even in the power output stages of quite small receivers and amplifiers, multiplying in magnitude as higher powered applications are envisaged.

As with valves already mentioned, so transistors may need assistance to get rid of their internally generated heat. Hence, of course, the heat sink.



Heat sink for an air-cooled transmitting valve.



Heat sink for a power transistor.

In the case of transistors used in receiver output stages, a very simple form of heat sink may suffice—a piece of metal formed into a tube at one end, which slides over the transistor case. Referred to sometimes as a "flag," it increases the surface area of metal available to lose heat by radiation and convection. Typically, a flag may be about 3/8-inch wide and up to 1-inch long.

In some cases, the flag may be bolted to a larger body of metal, portion of the chassis for example, or the body of a transformer. Heat from the transistor is then removed largely by conduction into the metal mass.

Where larger amounts of power are involved, a flag may not provide sufficient cooling effect and, in such a case it is common practice to design the transistor so that it can be mounted in intimate contact with a large body of metal. This may be a plate installed especially for the purpose, a specially fabricated heat sink with convection fins, or a section of the equipment chassis formed from copper or some other metal with good heat conducting properties.

Perhaps we should mention here that the body of the transistor (or other solid-state device) may be electrically connected to the internal junction, making it necessary to insulate the body from the heat sink. This is usually done with the aid of thin mica washers, smeared with silicone grease; this provides adequate electrical insulation, while allowing the heat to be conducted effectively from the transistor into the heat sink.

How does one decide upon the need for a heat sink and its size?

By far the easiest way is to be guided by circuit specifications or application data!

In fact, it is quite a difficult problem to determine the energy dissipation within a transistor in a particular class of service and to translate this into heat rise, allowing for the amount of heat the transistor can get rid of in its proposed environment. Complicating the issue is the tendency for transistor circuitry to "run away," due to heat causing higher current, causing more heat, causing higher current and so on!

As we said, it's a tough problem and, until you get well up the ladder in electronic design, be content to follow the guidance of those who have worked out instructions, or at least a suitable "rule of thumb" for the particular transistor and application you have in mind. Even then, you can't be sure that they did arrive at the result by pure calculation. There's a good chance that they arrived at the specification by actual trial—when no one was looking!

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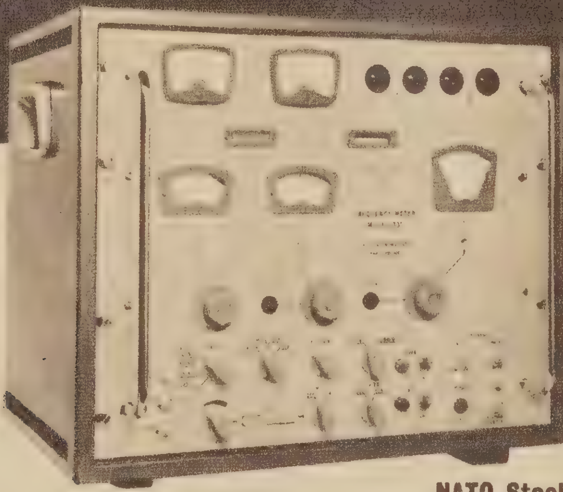

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There seems to be some uncertainty about the reading of photographic exposure meters. Is this because the meters are too small and cheap to be accurate and wouldn't there be a good case for a high accuracy meter?

We've used exposure meters plenty c times and had to make allowances i certain cases for readings which seeme consistently to err in one direction or th other. However, we doubt whether it' just a question of the meter movement The end result, photographically, woul seem to rest on three factors, at least:

THE CELL: It seems almost certai that sensitivity would vary from cell t cell and, further, that it might be affected by ambient temperature.

THE METER: As the question implies, these probably have their limitations, being necessarily small in size an built down to a price.

It does not follow, however, that th errors of cell and meter will necessaril add. On the contrary, we would expec manufacturers to adjust each cell an meter combination to give the righ reading under standard test condition by touching up the meter's magneti shunt. Thus, a slightly less sensitiv cell would be compensated by increasing meter sensitivity and vice versa.

THE CAMERA: Though the camer shutter may be set for 1/50th secon there is no guarantee that the actua effective speed will be in exact accordance. It may be higher or it may b lower but, short of having it tested, c cross-checking with other equipment, would be difficult for an individual use to tell whether meter or camera was t blame for consistent over or under exposure.

Again, there is the possibility—accidental this time — that errors ma cancel. Thus a meter which underrates the amount of light available ma mate perfectly with a camera whos shutter speed is a trifle low.

In considering the whole matter, is necessary to bear in mind that th concept of accuracy related to photographic operations is quite different fror that involved in measurements aroun electronic circuits.

An electronic technician thinks i terms of plus or minus 2 per cer accuracy for his routine multimeter an is liable to get upset if he senses tha the possible error has grown to 5 pe cent.

However, in the light of normal tolerance on photographic materials an processing, a cell-meter-shutter accurac of 5 per cent would be eminently satisfactory and, more than likely, no suspicion would attach to the set-up unt the error climbed toward 50 per cen representing about half a stop plus an minus!

However, even assuming a high ord of accuracy in cell, meter and camer readings require to be "interpreted" fo purely photographic — or pictorial - reasons.

Let's say that you visit the snowfiel and decide to take a picture of son friends facing into the sunlight and wi a darkly timbered ski-lodge in the background. You take a reading, set tl camera and snap the picture.

Immediately afterwards, you deci to take a second picture, with yo friends standing on snow, in the su light but this time with a brightly ski-slope behind them.

Most likely, your exposure met

ould give you a quite different reading,
ggesting the use of a much smaller
erture.
And, most likely, the second picture
ould be under-exposed.
This comes about because a conven-
nal exposure meter reacts to the total
ht reaching it from the general scene
d it is calibrated on the assumption
at the scene contains an average pro-
rtion of light and dark areas. This
ould be broadly true of a dark build-
g set in snow.
But with virtually all snow in the
ld of view, the meter would give a
gh reading, suggesting that the camera
ould be stopped down. In fact, it
ould not be stopped down if the
ow is to reproduce as full white and
e subjects' faces at the same "weight"
for the other picture.
More experienced photographers don't
themselves get caught by circum-
nces such as this and make deliberate
owance if they sense that the exposure
eter is looking at a scene which con-
ns an unusual proportion of light or
rk areas.
Better still, where there is opportunity
do so, they will move right up to
e subject and either take a reading of
e light reflected from the principal
bject alone, or else take a quite dif-
ent type of reading of the "incident"
ht falling on the subject.
In automatic cameras, where the ex-
sure is directly controlled by a built-
lightmeter, over or under-exposed
tures will normally result from non-
erage conditions unless the operator
liberately modifies the exposure, for
ample by changing the ASA setting
the camera.
In short, this much of the problem is
t a matter of meter accuracy so
ch as the limitations of trying to
sess a complex scene photographically
a simple total-light reading.
Some of the newer systems which are
t now being introduced seek to avoid
e problem by selectively measuring
ht and dark areas of the scene, so
at the exposure can be set to record
th more faithfully on the film. How
se work could well be the subject of
other article but, at least, we should
ve put you in the picture.

* * *

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any kind of automatic production.
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with other types capable of doing
same job.
2) The size factor. If encapsulated,
y tend to be bulky; if not, they can
ather vulnerable.
3) Being a naturally occurring sub-
nce, the mica dielectric is not as
y of access of control as competi-
manufactured substances.
or these, and possibly other parallel
ons, many of the circuit jobs once
tted to mica capacitors can now be
e more cheaply and conveniently by
r types. However, quite a lot of
a capacitors are still made, but main-
or specialised applications. ◘

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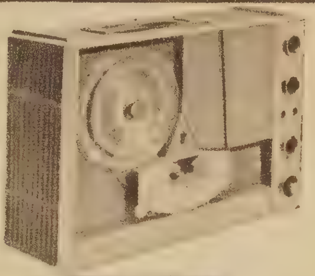

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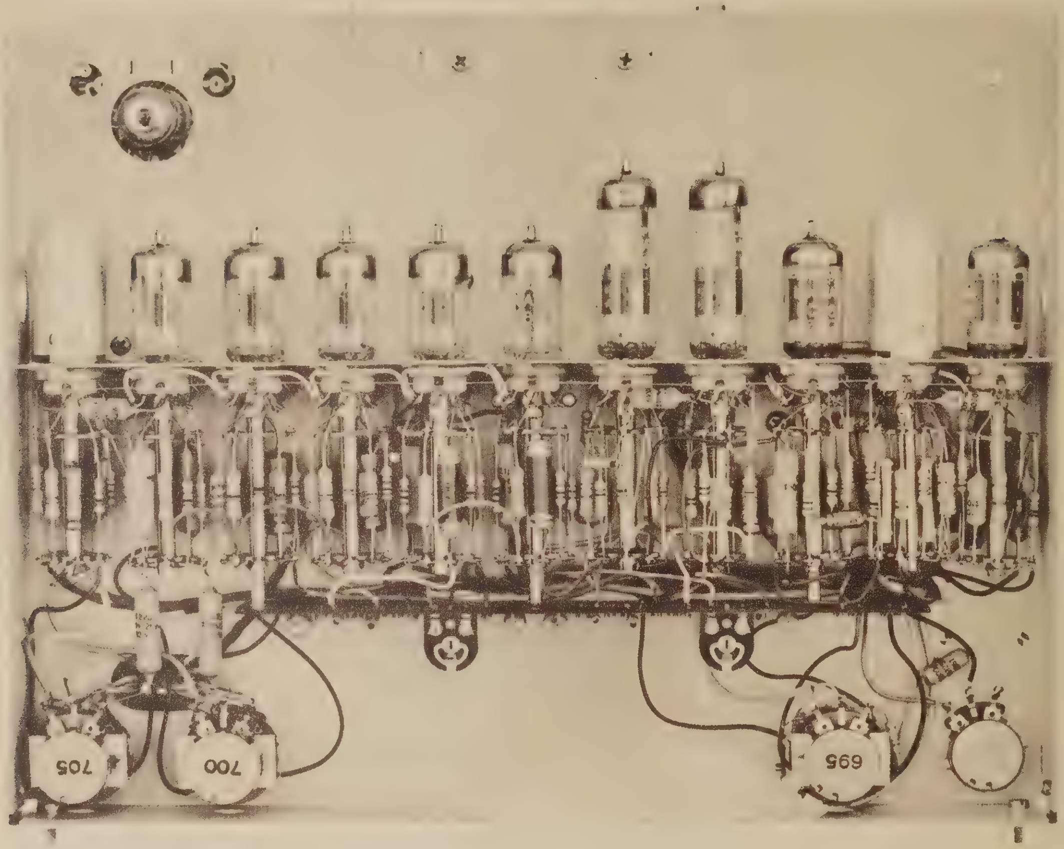

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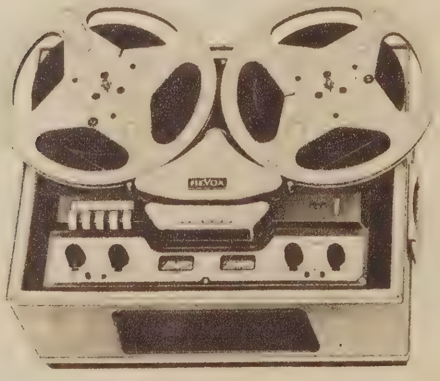

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AUDIO TOPICS

The Euphonics "MINICONIC" cartridge

A recent and notable development in high-quality gramo cartridges is the "Miniconic," a silicon semiconductor device manufactured by the Euphonics Corporation of Puerto Rico and released overseas only a few months ago. In view of the attention given to this unit in overseas journals it is of particular interest to learn that it is now available locally.

The Miniconic U-15-LS cartridge.

The sample units pictured were sent to our office for inspection and review by the Australian distributors, RCA of Australia Pty. Ltd. They comprise the TA-15 lightweight tone arm with U-15-LS (P1) cartridge, the U-15-LS cartridge, and the PS-15 power supply-preamp.

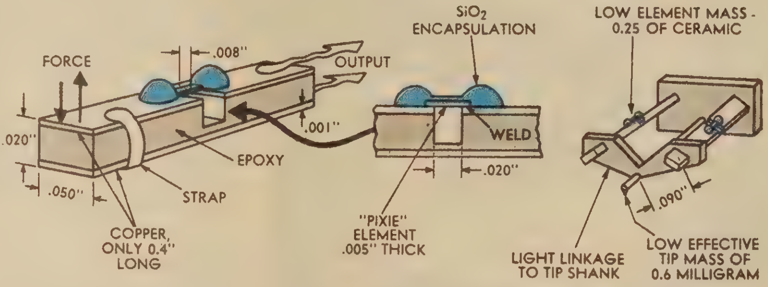
The heart of the Miniconic system is the cartridge, which is available in four versions: two "lab-standard" or LS close-tolerance models, also featuring a biradial or "elliptical" stylus, and two "professional" or P models using a conical stylus. The U-15-LS (P1) and U-15-LS models sent for review, and their corresponding "P" series equivalents, differ mainly in terms of the mounting arrangements those with the P1 suffix are for mounting on the TA-15 arm only, while those without the suffix are provided with a standard mounting bracket and ½in spaced fixing holes.

As John Borwick explains in this month's "Know Your Gramophone" article, the Miniconic cartridge is unique among modern cartridges in that it does not employ the stylus motion to generate an audio voltage directly. Rather it adopts the principle of the resistance strain-gauge, by using the stylus motion to vary the magnitude of a current supplied by an external power supply.

The actual strain-gauge elements in the Miniconic consist of microscopic 20- x 5- x 8-thou "Pixie" slivers of highly doped silicon. These are passivated and mounted across transverse ¾-through saw cuts in the centre of tiny 0.4in long x 20- x 50-thou strips of double-sided epoxy-copper laminate, the latter acting both as supports and as levers whereby the stylus motion is transformed into tension-compression effects at the two elements.

In operation, a DC bias of approximately 6mA is fed through the elements, which have a static resistance of around 800 ohms. As the stylus displacement varies the element resistances, stylus motion produces AC components in the two voltage drops, and it is these AC components which become the cartridge outputs.

It follows that the output is basically proportional to recorded amplitude or displacement. In this respect, then, the Miniconic may be grouped with the conventional crystal and ceramic types and contrasted with velocity-responding magnetic types — but virtually in this respect only.



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OUTPUT
.001"
.020"
WELD
EPOXY
.020"
.050"
STRAP
.090"
"PIXIE" ELEMENT .005" THICK
COPPER, ONLY 0.4" LONG
LIGHT LINKAGE TO TIP SHANK
LOW EFFECTIVE TIP MASS OF 0.6 MILLIGRAM

Construction of the Miniconic cartridge is shown in these diagrams, derived from Euphonics literature.

Output from the elements themselves is rated at typically 25mV for a peak recorded amplitude of .001in (corresponding to the standard recording level of 5cM/S RMS velocity at 1KHz). Internal mechanical compensation is fitted so that the output is nominally flat when playing R.I.A.A. recordings. Intrinsic response extends right down to DC, being limited only by output coupling capacitors.

The construction of the cartridge is such that the channel outputs are out-of-phase and, in contrast with conventional cartridges this cannot be remedied by simply reversing the connections to one element. Ideally a phase-inverter must be inserted in one channel. The PS-15 power source provides this phase inversion, in addition to a measure of preamplification and, of course, the DC supply for the elements.

Alternative output signals are available from the PS-15. The "HI" output is simply an amplified version of the flat-to-R.I.A.A. element outputs, at a rated level of some 400mV into 500 K or 100mV into 600 ohm lines. Alternatively one can select the "LO" output, which brings an inverse-R.I.A.A. filter into each channel to simulate the output from a magnetic pickup; output in this mode is rated as 8mV into 47K. (Both rated levels are for the 5cM/S standard recording level.)

Rated frequency response of the LS cartridges and PS-15 combination is 20-20,000Hz within plus and minus 2dB, with channel separation of 25dB at 1KHz and better than 10dB at 15KHz. Compliance is rated at 25 micro-cM per Dyne in both directions, and effective tip mass at less than 0.6gm. The nominal effective vertical tracking angle is the now-standard value of 15 degrees.

In our tests the sample cartridge substantiated these figures quite closely. Performance on the overload tracks of the Vanguard VSD-100 and CBS-Labs STR-100 discs confirmed the very high compliance and low tip mass, while the tone tracks gave curves which came closer than usual to the manufacturer's own. The only discrepancy was a small peak (3dB from reference) at 9KHz which seemed a little underdamped. Output was even higher than the rated figures: 20mV on "LO" and a remarkable 800mV on "HI" (5cM/S standard level).

In playing familiar program discs the Miniconic gave very clean reproduction, with smooth bass and low intermodulation distortion. On speech, sibilants seemed a trifle prominent — possibly this is due to the small peak at 9KHz noted above. Incidentally these tests were performed mainly with the cartridge in the TA-15 arm, at a tracking force of 1gm.

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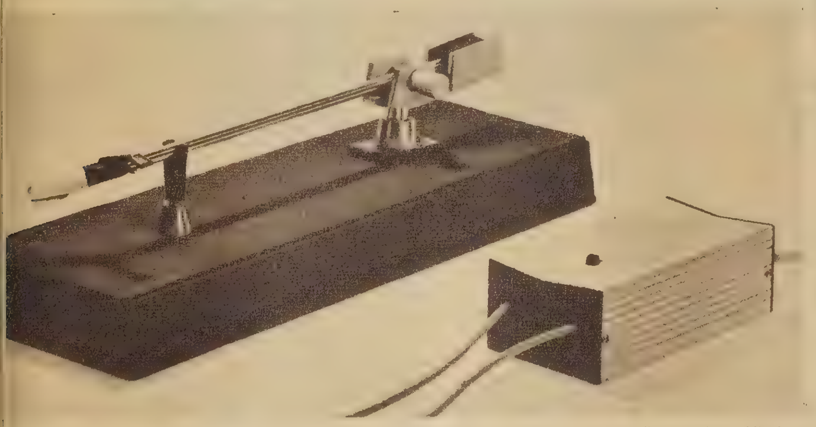
of the CBS-Labs STR-110 Square-Wave Test Record and the STR-160 Vertical Tracking Angle Test Record, and we used these to put the Miniconic through its appropriate paces.

Despite the small peak at 9KHz, the 1KHz square wave output has only a slight ring and was quite comparable with the better-quality magnetic cartridges which we have had the opportunity to test on square wave. Vertical tracking angle checked out at 22 degrees, with the arm set up as nearly parallel with the disk as one can judge by ordinary means.

In terms of performance alone, the Miniconic must undoubtedly be regarded as in the "upper class" among high-quality cartridges; its performance is certainly better than some well known magnetic cartridges, yet with advantages to be discussed in a moment. Better damping of the 9KHz peak could conceivably make it the equal of any cartridge currently available.



The complete Miniconic "Lab Standard" system, with U-15-LS (P1) cartridge, TA-15 low-mass arm, and PS-15 power unit.

Combined with its high standard of performance the Miniconic offers a number of advantages over conventional piezo-electric and magnetic cartridges and these "side benefits" could well result in wider adoption of the Miniconic principle.

Not only is the output from the cartridge elements about five times larger than that from magnetic cartridges, but it is both "flat" to RIAA and at a low impedance. These features mean that less pre-amplification is required, that no elaborate equalisation circuitry is required, and that the cartridge is well suited for matching into semiconductor circuitry.

The combination of low internal impedance, high relative output and non-sensitivity to electro-magnetic fields holds promise of good signal-to-noise ratio under a wide variety of practical conditions, using the word "noise" in its widest sense. In their literature, the manufacturers refer to a figure of -68dB as the best they could find in competitive equipment; in the face of this, they claim -80dB for the Miniconic system.

From a fabrication viewpoint the cartridge is probably easier to manufacture than either the piezo-electric or magnetic variety. Almost any plant manufacturing semiconductor devices could turn out the silicon elements; it is claimed that all the cartridges components are more rugged mechanically, electrically and thermally than those used in conventional cartridges, permitting far easier handling.

And reliability should be far and away better than either the piezo-electric or the magnetic types. There are no thermally—or moisture-sensitive crystals or delicate coils of wire; just two silicon-dioxide (quartz) encapsulated slivers of silicon. Euphonics claim to have had the elements working both at -50 degrees C and when RED HOT—testifying to their high thermal tolerance.

The TA-15 arm is an extremely lightweight unit: the lightest we have yet seen. Complete with the U-15-LS (P1) cartridge it weighs only 14gms. System resonance is at a low 12Hz, and very well damped. The vertical bearings are viscous damped precision ball races, and playing force is adjusted by a pivot torsion spring over the range 0.5-3gm. It is dynamically balanced, but has no side thrust compensation.

Altogether a fine arm, and a very fitting companion to the high-compliance Miniconic cartridge.

Finally, the instruction booklet is most helpful and comprehensive. Not only does the manufacturer give the equivalent circuit for the cartridge, together with design suggestions regarding power supplies and amplifiers, but he also gives the full circuit for the PS-15 supply. There is no hint of the "buy our supply or work out your own" attitude of secrecy all too common among manufacturers of audio components in general and "breakthrough" components in particular. Certainly a most refreshing change.

The one thing which detracts from the appeal of the Miniconic is the price. It's certainly not cheap: the complete LS system (arm, cartridge and power unit) sells for $144, while the LS conversion kit (standard-mount cartridge and power unit) is priced at $94. However, the enthusiast with initiative may care to note that the cartridges are available alone, together with the above-mentioned informative instruction booklet, at the more attractive figures of $49 (LS models) and $27 (P models). There is thus a relatively easy way to gain the Miniconic performance at a reasonable outlay.

In any case I should think the prices will fall when Euphonics go into large-scale production. And considering the many attractions of the Miniconic, this day may not be too far off . . . (J.R.)

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	41-12	1200	7	4.50	2.25
Ferrotape 43 *• 1 mil Acetate Base • Long Play Professional Quality.* *Type 43 1 mil Acetate tape is available for maximum economy with an extended play of 50%. As companion to the standard economy Ferrotape, it offers the same excellent reproduction and performance.*	Long Play 1 mil Acetate				
	43-9	900	5	4.00	2.00
	43-18	1800	7	6.50	3.25
Ferrotape 52 *• 1 mil Polyester Base • Long Play with Strength • Long Life • Dimensional Stability.* *Type 52 is ideal for professional educational or home recordings where high strength, long life and dimensional stability are required plus 50% greater recording time.*	Long Play 1 mil Polyester				
	52-9	900	5	4.40	2.20
	52-18	1800	7	7.50	3.75
Ferrotape 53 *• ½ mil Polyester Base • Extra Long Play Type 53 is for extended play applications where care is exercised in handling. It should be used only on equipment in good adjustment and by an experienced recordist.*	Extra Long Play ½ mil Polyester				
	53-12	1200	5	4.60	2.30
	53-24	2400	7	8.50	4.25
Ferrotape 56 *• ½ mil Tensilized Polyester Base • Extra long play • Extra Strength.* *Type 56 ½ mil Tensilized Polyester makes it extremely strong and stretch-resistant, retaining the extended play features.*	Extra Long Play ½ mil Tensilized Polyester				
	56-12	1200	5	6.50	3.25
	56-24	2400	7	11.00	5.50
Ferrotape 57 *• ½ mil Tensilized Polyester Base • Extra Thin High Output Coating • Extra Extra Long Play.* *Type 57 offers three times the playing time on a Tensilized Polyester base. Ideal for use in extended recording sessions to avoid interruptions in programme material. Resists stretching and breaking under relatively rough handling conditions.*	½ mil Triple Play Tensilized Polyester				
	57-18	1800	5	9.00	4.50
	57-24	2400	5¾	11.70	5.85
Ferrotape 59 *• ½ mil Polyester Base • Extra Thin High Output Coating • Extra Extra Long Play.* *Type 59 offers three times the playing time where care is exercised in handling. It should be used only on equipment in excellent adjustment by an experienced recordist.*	½ mil Triple Play Polyester				
	59-18	1800	5	6.50	3.25
	59-24	2400	5¾	8.50	4.25
	59-36	3600	7	12.00	6.00

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A plain man's guide to records and reproducers

By JOHN BORWICK, B.Sc.

PART FOUR—PICKUP CARTRIDGES

Modern pickup cartridges are so tiny that you need a magnifying glass to study the component parts. However, given this magnification, electrical engineers would soon recognise the features which make up an ordinary electrical generator, a dynamo or perhaps an industrial measuring instrument such as a strain gauge or seismograph.

Pickups share with all these devices the common principle that physical movement is arranged to produce a related electrical signal.

Various methods are used to achieve this conversion of the mechanical energy of motion into the electrical energy of electrons flowing in a wire. Pickups, as we shall see, may use the piezo-electric crystal effect, electromagnetic induction or (as in the new Miniconic cartridge) variable resistance.

Types of Pickup: Crystal cartridges are mechanically simple. They depend on the fact that physical distortion of certain crystalline materials will set up an electrical charge. Crystals of quartz or water soluble materials, notably Rochelle salt, are grown and then specially cut on the axis which displays the greatest piezo-electric effect.

Suitably clamped at one end between metal foil contacts (or electrodes) such a crystal only requires simple coupling of the "free" end to the stylus whereupon movement from side to side will produce the required alternating positive and negative voltages. A typical arrangement is illustrated in figure 1.

Various refinements are incorporated in practical pickups, such as compliant mountings and back-to-back sandwiches or "bimorphs" of crystal to improve the performance.

Crystals are, however, affected by both temperature and humidity—can even break down altogether at very high temperatures. Their main advantages are simplicity, low cost and high sensitivity: a typical output voltage is 0.15 volt (150mV). Examples: Acos GP93, Garrard, GC8, Ronette TX88.

The modern ceramic cartridges use the same principles but are non-water solvent and are man-made in a polarising process which controls the direction of maximum piezo-electric effect. The sensitive element can be very small and light and much less dependent on ambient conditions.

Sensitivities are around 0.05 volt (50 mV). Examples: BSR C.1, Connoisseur SCU1, Decca Deram, Goldring CS90, Sonotone 9TA.

Magnetic pickups all depend on the basic electromagnetic phenomenon that relative movement between a magnetic field and any piece of metal capable of conducting electricity results in the generation of electricity. The different types of magnetic cartridge (see figure 2) have evolved because it is possible to get this relative motion in several ways:

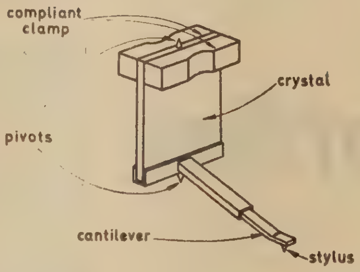

Figure 1: One form of crystal cartridge in which the piezo-electric charge is set up by a twisting movement.

1. Moving coil pickups contain a fixed magnet and a tiny coil of fine wire which is rocked by the stylus vibrations. Examples: Expert, Ortofon SPU-GE.

2. Moving magnet pickups contain a fixed coil and a tiny magnet which is rocked by the stylus vibrations. Examples: Elac STS322, Empire 880P, Pickering V15, AMI, Shure M55-E.

3. Moving iron pickups contain a fixed coil/magnet assembly and a soft iron armature which is rocked by the stylus vibrations and causes the magnetic field to fluctuate. Example: B and O SP1.

4. Variable reluctance pickups contain a fixed coil and pole piece/magnet (magnetic circuit) assembly and pivoted ferrous arm which is rocked by the stylus vibrations and causes the magnetic field to fluctuate. Examples: Decca ffss, EMI EPU100, Goldring 700, Tannoy Vari-twin.

5. Induced magnet pickups contain a fixed coil and a fixed magnet which induces its field into a tiny moving armature which is rocked by the stylus vibrations. Examples: ADC Point 4, ADC 660.

The conflicting requirements facing all magnetic pickup designers are the need for maximum coupling efficiency in the magnetic generator (greater sensitivity) and the need to minimise the mass to be moved by the stylus (particularly important for the tracking of high level, high frequency signals). As things are at present, the sensitivities of good quality magnetic cartridges are very low, around 0.0015 volt (1.5mV).

A new type of cartridge should also be mentioned: it is the Miniconic which has been launched by the Euphonics Corporation of Puerto Rico.

The Miniconic is described as a semiconductor cartridge (though this should not be read as implying that a transistor device is incorporated) and the action in some ways resembles that of a carbon microphone in which varying resistance is used to modulate the current drawn from a DC voltage supply.

The construction of the Miniconic element is illustrated in figure 3. The stylus vibrations alternately compress and elongate a tiny piece of silicon through which is flowing the current from a 20-volt DC supply unit. The resistance is thus made to vary, and the alternating component in the current can be taken off as the pickup output.

Sensitivity can be high from such a construction, and the Miniconic is rated at 0.025 volt (25mA) open circuit. When used with its own supply/matching unit, it provides 400mV or 8mV for connecting respectively to the crystal or magnetic inputs of an amplifier.

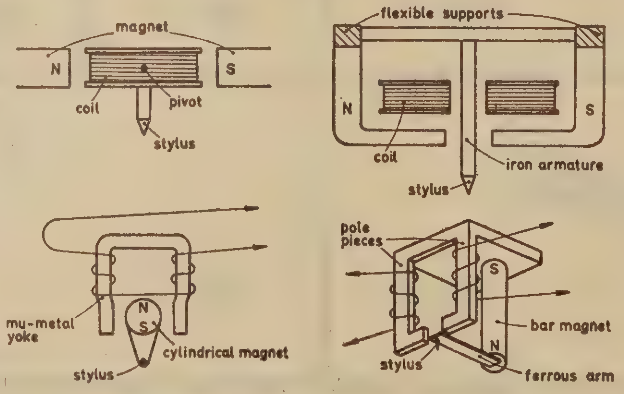

Figure 2: Four types of magnetic pickup, including a moving coil and moving magnet (left); moving iron and variable reluctance (right).

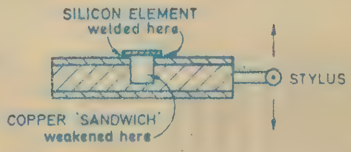

Figure 3: Showing the principle of the Miniconic pickup cartridge. The stylus movement causes the electrical resistance of the silicon element to vary about a mean value.

After this brief description of the different ways in which gramophone pickups generate the electrical signal, we can now discuss the physical action which is common to all pickup types.

Groove is the prime mover: When a pickup is playing a record, the groove is propelled under the stylus (needle) and the recorded waveform causes the

---

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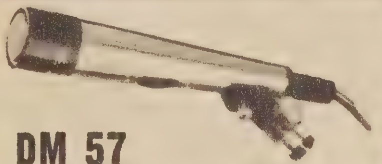
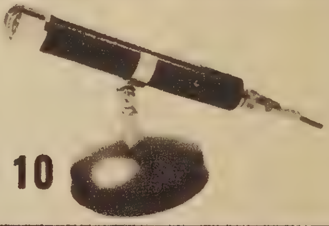


DM 57

DM 17

DM 51

DM 13



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stylus to waggle from side to side. (It is assumed that the stylus tip is of suitable dimensions to follow the waveform and that the stylus is pivoted or supported with sufficient freedom of movement so that only the stylus vibrates and the pickup cartridges as a whole does not.)

In the early acoustic gramophone sound boxes there was no conversion to electrical energy. The needle movements were coupled by lever action to a diphragm, for more effective generation of air movement—and the air vibrations were "amplified" by a conical horn.

It is certainly a scientific marvel that a single waveform in the groove can contain all the complexity of sounds in a work such as the Berlioz Grande Messe des Morts. But the fact remains that the air particles surrounding our ears at a concert are somehow performing just such a complicated vibration: once committed to the groove and reproduced through a loudspeaker, this waveform can at any future time recreate a similar air disturbance at our ears.

The notes of even a single musical instrument are relatively complex, being made up of the fundamental pitch frequency (which determines the musical pitch of the note) and a series of harmonics or overtones (which give the instrument its particular character or timbre).

All waveforms, however complex, can be analysed into a fundamental and a series of harmonics each of which represents a single frequency — whose waveform is the familiar sine wave. One complete cycle of a sine wave is shown in figure 4 together with a line to represent the stylus movement in tracing out this cycle.

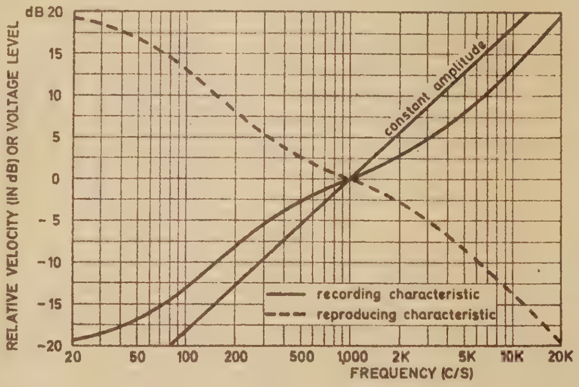

Figure 6: Present-day LP recording and reproducing characteristics, with a straight line to show the 6dB per octave constant amplitude response.

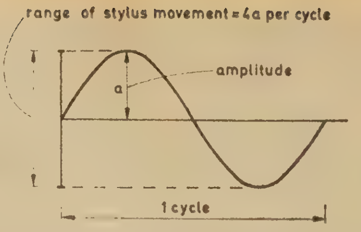

Figure 4: One cycle of a sine wave of amplitude a. The distance travelled by the stylus is 4a.

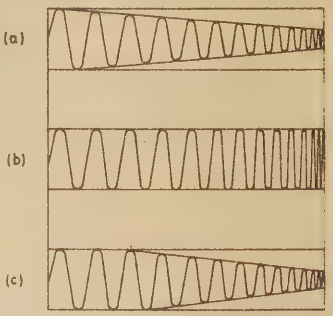

Figure 5: Comparing the amplitudes over the frequency spectrum in (a) constant velocity, (b) constant amplitude and (c) prewar standard recording.

An important feature of the waveform is the amplitude a, which is the peak distance by which the stylus is displaced to right or left of the centre line. Another important property is the stylus velocity v, which is defined as the total distance traversed per second. The velocity depends on the amplitude, of course, but is also proportional to the frequency, since doubling the frequency will double the number of cycles per second. In symbols, we say:

Distance per cycle equals 4 x a.

No. of cycles per second equals f (frequency).

Velocity v equals total distance per second equals 4af.

Constant amplitude or constant velocity? We are now in a position to study two terms much used in gramophone recording. The first, constant velocity, implies a method of recording in which the cutter stylus is given the same velocity at all frequencies. Therefore, to keep $4af=v$ at all frequencies, the amplitude must increase as the frequency is reduced (see figure 5a). In practice, this could mean unusably large amplitudes — calling for very wide grooves and impossibly large stylus swings.

A constant amplitude system of recording will avoid this difficulty at the bass end (see figure 5b), but it introduces an equally serious problem at high frequencies where the velocity will rise to impractical values.

Since the early days, therefore, the recording companies have tended to use a combination of constant velocity and constant amplitude recording. A typical early recording curve or "characteristic" would be constant velocity (that is the amplitude is halved for each octave above a certain turnover frequency) at the top end and constant amplitude at the bottom end (see figure 5c).

In addition, there grew up a tendency to boost the high frequencies so that the cutting of treble on replay would also help to reduce troublesome surface noise. Many variations used to be practised, requiring slight changes in the electrical characteristics of the reproducing amplifier for the different makes of record. (The Quad Control Unit, for example, is supplied with a list of over 60 record makes with a code for introducing four different combinations of correction networks.)

With the drawing up of international standards, however, and the arrival of microgroove discs, a single recording characteristic is now used by virtually all recording companies, and that for mono and stereo L.P. records is illustrated in figure 6 (drawn in terms of relative velocity or voltage level).

For proper reproduction, the playback chain should have an overall characteristic which is an exact mirror image of this. How this is achieved depends on whether the pickup is a magnetic or crystal/ceramic type.

Magnetic pickups produce an electrical output which is proportional to velocity: the better quality units therefore produce the recording characteristic almost exactly. They therefore require to be connected to an amplifier which incorporates an "equalising" network with a response equivalent to the broken line in figure 6.

Crystal/ceramic cartridges, by contrast, are amplitude devices and will tend to produce an output signal which is not much more than 6dB away from the required flat characteristic (compare the "constant amplitude" line drawn in figure 6). This relatively small departure from a flat response is normally compensated in the mechanical design and electrical loading specified for individual cartridges, so that no equalisation is necessary for average usage.

Impedance matching: Just as all pickup types can be lumped into the two categories, magnetic or crystal/ceramic as far as their need for equalisation is concerned, they can also be so grouped for impedance. Magnetic pickups are basically low impedance, inductive devices. Conventionally, most current types are designed to work into an impedance of the order of 50,000 ohms; the inherent capacitance of screened coaxial cable will affect the frequency response, so short leads are best.

Crystal/ceramic cartridges are high impedance, capacitative devices and should work into an impedance of around 2 megohms (2,000,000 ohms). A lower impedance will reduce the output at low frequencies. The cable has no effect on frequency response, though

(Continued on page 141)

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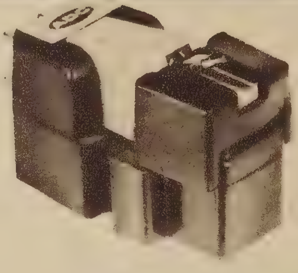

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"Compliance is extraordinarily high . . . dynamic mass is not specified but is, in the judgement of Nationwide Consumer Testing Institute EXCEPTIONALLY LOW . . . NCTI'S measurements indicate very smooth and uniform response across both channels; the left channel was flat within +o.5, —2 db out to 20 KHZ, the right channel, within +2, —1.5 db out to 20 KHZ . . . channel separation remained better than 27.5 db across most of the range up to 5 KHZ and was still better than 15 db at 20 KHZ, WHICH IS OUTSTANDING FOR A PICKUP . . . measurements and theory aside, the real test of the 10E is in the hearing . . . the cartridge negotiates the most demanding of recorded passages with the ease of a thoroughbred, and its sound is always balanced and neutral (stylus force 1 gram)—**IT IS THE SOUND, AS FAR AS WE CAN DETERMINE, OF THE RECORD ITSELF . . . IT IS THE KIND OF PICKUP, HOWEVER, THAT ALMOST DEMANDS BEING USED WITH THE BEST ASSOCIATED EQUIPMENT."**

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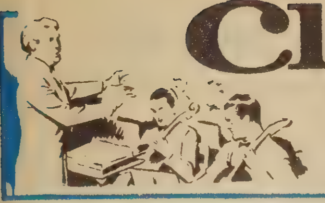

Classical reviews

By JULIAN RUSSELL

Bruckner Symphony . . . "forceful and majestic"

BRUCKNER—Symphony No. 4 in E Flat (The Romantic). London Symphony Orchestra, conducted by Istvan Kertesz. Decca Stereo SXL6227.

This is the most genial of Bruckner's symphonies—if that adjective can be used at all to describe the pious master's output. At any rate it is well named "The Romantic," especially if the first horn call comes off as well as it does here. In all music I know of only one comparable phrase to open a work so—I have to use the word again—romantically. That is the three-note horn call in the first bar of Weber's "Oberon" Overture. And these first notes in the Bruckner are of supreme importance in a successful performance.

In the LSO performance under review they are played by the incomparable Barry Tuckwell—an Australian, incidentally—who told me in Sydney last April that though the notes themselves present no problem to a competent player, the anxiety that one of them, usually the first, might "bubble" is so great among even the best performers on the instrument that they are never comfortable until they have successfully delivered them. Tuckwell, on tour with the LSO at the time, summed up the problem: "If the notes don't come off, it's no good starting the symphony again. You might as well play something else."

At any rate, they are produced as successfully here as they were when the LSO played the symphony in the Sydney Town Hall last April—beautiful, smooth notes, sounding as poetically remote as if heard in a distant woodland. But though Tuckwell's playing is of the same high standard throughout the work the engineering offers so wide a dynamic range that later his very soft notes are barely audible, and to hear them comfortably the volume must be increased so that the fortissimo passages nearly blow you out of the room. But I hasten to add that by starting my notice with this criticism does not mean that this is either an inferior performance or recording. True, it is irritating that playing as superb as Tuckwell's might have fared just a little better but I found nothing else to complain about in the engineering.

The only comparable competitor to Kertesz' reading is Klemperer's with the Philharmonia for Columbia—and I have not forgotten, either, Walter's fine performance with the Columbia Symphony Orchestra, nor Jochum's with the Bavarian Radio players. And now I must again write that the one you will prefer of the first two will be largely a matter of personal preference. Some may like Klemperer's more lofty account based on that conductor's customary ultra-solid foundation. It is indubitably impressive, both forceful and majestic without sacrifice of lyricism. But, for my taste, Kertesz' reading is slightly more—for want of a better word I write—chummy. However despite this approach Kertesz never trivialises Bruckner's thought, nor does he play down to his audience.

He seeks no cheap effects and no overemphasis. If, for instance, Klemperer takes the "Hunting" scherzo slower than Kertesz, he imparts considerable rhythmic weight in the process. But Kertesz' slightly faster tempo conveys, at any rate to me, more of the bustle of a hunt with horns and trumpets calling to each other more urgently. Both conductors give full weight to the composer's sturdily wrought climaxes. The playing of both the LSO and the Philharmonia is supremely good.

Decca's sound is good, but I have heard better on that label. Columbia's is undeniably better, especially in the matter of balance. There is, too, on my pressing, an odd noise in the middle of the slow movement of the Decca, but whether it is a blemish in the pressing or something on the tape I cannot work out. My personal preference is for the Decca performance, despite its minor shortcomings, but you may well disagree—and for very good reasons. And I might add that I enjoyed the Sydney performance given live in the Town Hall ever so slightly more than the recorded one under notice here.

* * *

MAHLER—Symphony No. 10 (Cooke version). Philadelphia Orchestra conducted by Eugene Ormandy. CBS stereo. S2BR220018/9.

When Mahler died in 1911 he left his 10th Symphony unfinished. The whole work had been sketched out and some of it had even been finished in full score—as far as the Purgatorio. The rest existed either in the original four-stave short-score sketch, or sometimes in just the melodic line without harmony or indication of what instruments Mahler had in mind to colour it. It was this score which Mahler's widow published in photographic facsimile in 1924, and in the same year the composers Krenek and Berg produced a performing copy of the first Adagio and the Purgatorio.

This was the two-movement version that was published—with some changes that most Mahler-lovers considered deplorable—in 1951. Arnold Schonberg, then domiciled in Hollywood, was considered by many the best choice of someone to complete the whole symphony, but he modestly declined, stating as a reason that the task was beyond his powers. It was not till 1960 that English critic and musicologist Deryck Cooke (perhaps England's leading authority on Mahler) completed the score, filling in the blanks in both the harmony and orchestration. Its first performance in this form was given in a broadcast by the B.B.C.

On hearing of this event, and with Schonberg's reasons for refusing to complete the work in mind, Mrs Mahler, who held the performing rights, forbade any repetition. It was not till 1963 that she finally approved Cooke's version, and she died shortly afterward, enthusiastic to the extent of congratulating him on his work on the symphony.

There are two points of view to be considered in estimating the value of the Cooke version. For though he worked on a sketch in which every bar had been set down by the composer, despite the frequent omission of harmony and orchestration, the symphony would most certainly not have been completed by the composer himself in the form Cooke adopted. As Cooke himself stated, " . . . the substance (was) all there in the manuscript, even if the finished texture and sonority (was) not." And the composer's handling of these features might well have differed importantly from Cooke's.

But Cooke has for many years been so steeped in Mahler's music and has always been in such complete sympathy with it that however Mahler might have finished the work, Cooke's editing was done so skilfully that I doubt if any Mahler lover, without a copy of the original score, could tell where Mahler's work ended and Cooke's began. This means that the symphony is now available to the many thousands who will buy the set under review — and perhaps other sets which will follow — to whom otherwise it would have existed only in a score many of them could not read or might not even be able to obtain. True, it is now only a second-best version, but it is still the best form in which the work is available and, in my opinion, a valuable addition to Mahler's oeuvre.

Not unexpectedly, noisy charges of impertinence have been made against Cooke in some purist quarters, especially in German-speaking countries, but I think less serious-minded listeners will welcome his work as being considerably better than no symphony at all. Cooke's modest explanation of his devoted work on the score states categorically that he did not complete the symphony but merely prepared the composer's preliminary sketch for performance. And in my opinion, he succeeded brilliantly.

Taking it all round, Ormandy's performance is an admirable one, give or take such minor shortcomings as an occasional stiff tempo delivered without the rubato Mahler was so keen on and, here and there, the slightest evidences of rhythmic indecision, usually in the brass. There is also the matter of balance, which sometimes favours instruments that would, in a concert hall performance, sound very faint indeed. However, these are only trifles in a considerable achievement by all concerned, for otherwise playing and recording leave nothing to be desired.

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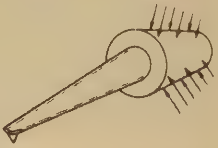

TECHNICAL SPECIFICATIONS

MODEL	888	888P	888PE
Frequency Response	10-24,000* cps.	8-28,000* cps.	6-30,000* cps.
Output Voltage	8.0 mv per channel	8.0 mv per channel	8.0 mv per channel
Channel Separation	more than 30 DB	more than 30 DB	more than 30 DB
Compliance	10×10^{-6} cm/dyne	15×10^{-6} cm/dyne	20×10^{-6} cm/dyne
Tracking Force	¾ to 6 grams	½ to 4 grams	½ to 3 grams
Stylus	.7 mil radius	.6 mil radius hand-polished diamond	.2 x .9 b.-radial elliptical hand-polished diamond
Terminating Impedance	47,000 ohms	47,000 ohms	47,000 ohms

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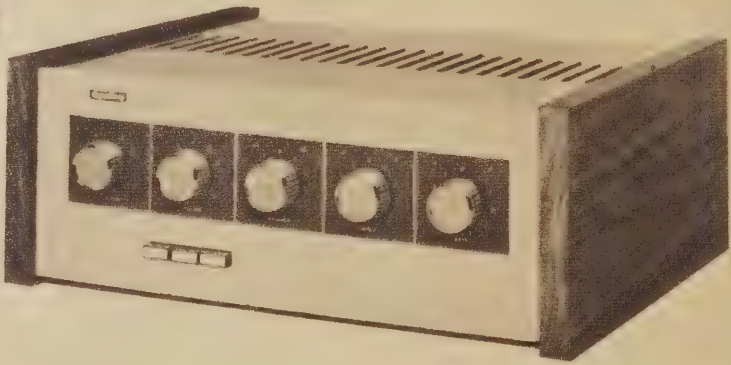

TT1 INTEGRATED STEREO AMPLIFIER
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The 221 Amplifier is designed for use primarily with magnetic pick-ups but inputs are also provided for the higher output ceramic and crystal pickups.

At its price the 221 represents a major breakthrough in high fidelity amplifiers. Never before has an amplifier of this quality, sensitivity and power, incorporating all these facilities been available in this price range.

TECHNICAL SPECIFICATION

The specification refers to overall performance and this should be borne in mind when comparing figures with amplifiers and control units quoted separately.

Power Output	10 watts push-pull per channel, R.M.S.
Frequency Response	30-20,000 c.p.s. ± 1dB.
Power Response	35-20,000 c.p.s.—1dB.
Harmonic Distortion	Less than 0.5% at 1K/cs measured at 8 watts output ± 1dB.
Hum and Noise	55dB below rated output.
Negative Feedback	15dB.
Output Impedance	Alternative 4, 8, 16 ohms.
Transient Response	Rise time 6 micro-secs.
Crosstalk	Better than 40dB.
Channel Matching	± 1dB.
Balance Control	Range of—10dB each channel
Treble Control	+ 15dB.,—12dB, at 10K/cs.
Bass Control	+ 12dB,—12dB, at 70 c.p.s.
Loudness	Switched. Superimposes increase in extreme bass and treble at low volume.
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Treble Filter	8 K/cs. with slope of 12db per octave above this frequency.
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COPLAND—The Tender Land. Abridged Opera. Joy Clements (Laurie); Claramae Turner (Ma Moss); Norman Treigle (Grandpa Moss); Richard Cassily (Martin); Richard Fredericks (Top); Choral Art Society and New York Philharmonic Orchestra, conducted by Aaron Copland. C.B.S. Stereo SBR 35154.

Although this is an abridged version, 53 minutes of playing are to be had on this disc without any noticeable sacrifice of tone. At a guess, roughly 40 minutes have been cut from the complete opera. Some of the missing passages might have helped to clarify motives, or at any rate prepare one's acceptance of those offered, but others were, I think, of little importance. However, there is no sense of incompleteness about the version offered here, although the cuts have weakened what was already one of the work's weakest features, the libretto.

This, according to the sleeve notes, was supplied by a "professional" but unnamed painter who used the pseudonym of Horace Everett. His characters all come from stock and lack depth, but have the advantage of being immediately recognisable as components of the American scene in the Middle West during the depression of the 1930s.

Set on a small Middle West farm, its plot tells of a young girl who desires a fuller life than she finds there. She grasps at a promise of this when she falls swiftly in love with one or two "drifters" who are allowed to sleep at the farm for the night. Her young man, after reflection, decides it would be wrong to separate her from the safety of her home when all he had to offer was a life on the road, but after he has departed, leaving her desolate, she decides to set out on her own anyway.

All this, of course, could fairly be described as American folklore, and Copland has provided it with music to suit. Some of it is commonplace, some movingly lyrical. All is very expertly assembled. And since it was "conceived for workshops and colleges as well as for professional companies" (sleeve notes) its performance would not be beyond quite modest means. Harmonically, much of it is warmer than you usually find in Copland's work, though even at this temperature the climatic love duet is a little short of true passion.

There is a Graduation Party in the good old musical tradition of such scenes, with small talk, dancing, choruses and such like devices that owe more than a little to Puccini's "Girl Of The Golden West." The opening bars of Side 2 have something of the mysterious charm of a Bartok nocturnal slow movement. At times the various vocal melodies remind one inevitably of Gershwin's "Porgy and Bess," while the opening to Act 3 pays tribute to the dawn scene in Britten's "Peter Grimes."

But, all in all, it is a pleasant score, making only few demands on the listener with enough that is truly original to sustain interest throughout much of its short length. The fact that no libretto accompanies the disc is countered to a great extent by the admirable clarity of the diction of all the singers. No one should have any difficulty in following the simple story. The cast is generally excellent with Joy Clements outstanding as the young girl — fresh voiced, expressive and truly pitched. The only less satisfactory contributor is Richard Cassilly as her lover, who often becomes a little unsteady in tone.

Copland himself conducts the New York Philharmonic admirably with scrupulous attention to balance and ensemble. But even under his impressive direction the opera seldom emerges from what I can only describe as a static pictorialism. It is difficult to imagine it winning any great popularity outside the United States.

* * *

SIBELIUS — Symphony No. 3 in C. Symphony No. 7 in C. Scottish National Orchestra, conducted by Alexander Gibson. Columbia Stereo SAX 3209.

The music of Sibelius calls for strongly characteristic treatment that the English acquired as long ago as the 1920s. This was perhaps due to the insistence of such leaders of English musical thought as Ernest Newman and Constant Lambert and the younger generation's tireless advocacy of his music. If, as in the case of Lambert, this was made at the expense of a fellow-composer as great as Stravinsky—well, we all make mistakes. And this particular one did Stravinsky no harm and made the music of a man born on the northern tip of Europe (music that otherwise might have been neglected) as well known in England as it was in his native Finland.

Gibson and the Scottish Orchestra—which I have not heard since I can remember—are well grounded in the true Sibelian tradition. Their playing keeps the music stark and spare and they are never betrayed into converting the warmer moments into what could be mistaken for Brahmsian luxuriance. (Leonard Bernstein, whom I heard conduct the Sixth Symphony with the New York Philharmonic in New York last year, failed to avoid this trap.) Gibson's tempos are steady without being rigid and a similar steadiness is evident in the dynamic nuancing, except, of course, where Sibelius' climaxes blaze dazzingly out of the score.

Everything is intense while at the same time avoiding any suggestion of the muscle-bound. All these features, combined with playing that is always accurate, and, in delicate passages, rewardingly sensitive, should have added up to performances of quite outstanding merit. But one characteristic feature of the music is seldom in evidence — a virile cool tone in the strings and crackling brass in the climaxes. It all sounds just the slightest bit too refined, and this to an extent that largely nullifies the superbly original quality of Sibelius' scoring.

These shortcomings are never obtrusively apparent. But one has only to play the performances recorded some 12 years ago by Anthony Collins for Decca, and now available on the cheap Ace of Clubs label, to spot the differ-

Menuhin conducts modern classics

20th CENTURY CLASSICS FOR STRINGS.
Stravinsky—Concerto in D.
Hindemith—Five Pieces for String Orchestra.
Bartok—Divertimento for Strings. Festival Orchestra, conducted by Yehudi Menuhin.
HMV Stereo OASD2255.

Yehudi Menuhin and the Bath Festival Orchestra are usually heard in baroque or classical compositions. On this disc they offer works of a later period just as efficiently and just as musically. In the Stravinsky item I should have thought the tone a trifle too lush for that composer's middle period work had I not heard Stravinsky himself achieve an identical effect some four years ago when he conducted his ballet "Apollo" in the Hamburg Opera House with the Balanchine company dancing this "ballet blanche." Stravinsky, too, won playing of extreme warmth from his players, as Menuhin does here in the Concerto in D.

But this tonal luxuriousness is not won at the expense of effective pointing of the many broken rhythms nor does the exquisite clarity of the phrasing suffer either.

The concerto is 20 years old; the Hindemith work was written in 1926, at a time when the composer was making a reputation for himself by producing what he called "Gebrauchmusik," which may be loosely translated as "bread and butter music"—music written to order for everyday use. This practice was by no means new, as anyone with a knowledge of eighteenth century composers and the conditions under which they worked for their noble or ecclesiastical patrons will agree.

I must admit that while I always admire Hindemith's very great technical skill, his music seldom speaks to me eloquently, even when it is as well played as you hear it here. It all strikes me as much too cerebral and melodically below normal temperature. True you will hear tunes rather more ingratiating than usual in the slow movements, offered with much skill and devotion. But in the faster ones Hindemith goes back to his old style of churning out bar after bar in a manner that might truly be described as "bread and butter."

After this exercise in mere ingenuity, Bartok's Divertimento sounds quite fervently inspired. There is an air of folk music about the whole work, though most of the tunes are the original ideas of their creator. It dates from 1939, which means that it followed Bartok's minor essay into serial style, the Violin Concerto. I mean by that, of course, it is the serial treatment of some of the bars and not the concerto itself that is a minor essay.

The first and last movements of the Divertimento are made up for the most part of dance tunes played with the maximum of rhythmic bounce. I could have hoped, however, for just a spot more gipsy abandon in this very Hungarian music. But I can find nothing but praise for the slow middle nocturnal section, which builds into a noble melodic arch beautifully realised by Menuhin and his players. Menuhin was one of Bartok's first eloquent advocates. I have an idea that his was the first recording of the Violin Concerto. His eloquence has not deserted him over the years.

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ence. In this similar coupling the bite on the brass tone and in the strings intensifies Sibelius' orchestral colours, which, for the greater part of the works, are always kept as distinct as those in a Gauguin painting. Here are no hues but primary colours set down straight on to the canvas.

Not surprisingly the sound on the old Decca cannot compare with the much more modern engineering you have on the new HMV. But it is still eminently acceptable, and though Gibson and his men offer very good Sibelius indeed, to me, Collins' is to be preferred.

★ ★ ★

MOZART—Serenade No. 13 in G (Eine Kleine Nachtmusik) (K.525). Symphony No. 25 in G Minor (K.183).
HANDEL—Concerto Grosso, Op. 6, No. 4 in G. New Philharmonia Orchestra conducted by Otto Klemperer. Columbia Stereo SCX 5252.

For some time now a movement has been getting under weigh overseas to advocate the placing of the first violins on the left and the seconds on the right of the conductor during orchestral concerts, especially when eighteenth and early nineteenth century music is played. The reason is, of course, that most composers at that period always had in mind the antiphonal effect possible if the violins were seated on different sides of the orchestra. By the way, such placing was not mandatory even in the eighteenth century, though the practice was pretty general.

Even as late as Wagner's "Tristan and Isolda" the composer obviously had in mind antiphonal effects when writing, in the climax of the prelude, upward rushing string passages on the violins, first from one side of the orchestra, then from the other. Later composers tended to write more homogeneously for the violins with the result that most conductors now seat firsts and seconds side by side, usually on their left.

Klemperer is one of the few to follow the earlier practice and nowhere can the result be heard to better purpose than in the stereo version of this serenade, and, perhaps even more so, in the Handel piece. His reading, too, is a flat contradiction of the widely held opinion that Klemperer is a heavy-handed conductor of Mozart. His playing here is always sinewy and firmly skeletoned, as it should be, but it often achieves a delicacy and charm that not even the late Bruno Walter could have excelled. I know of no more beguiling performance of "Eine Kleine" nor of one that has been provided with a more suitable acoustic and general spread.

The Handel, too, is full of good things, the playing sturdy but supple, the tone quality that of the Philharmonia at its best. And to make up generous playing time, Mozart's "little" G Minor Symphony (K.183) is thrown in as a fill. Highly recommended.

★ ★ ★

BRITTEN—Sinfonietta for Chamber Orchestra. Opus 1.
HINDEMITH—Octet.
Played by the Vienna Octet. Decca Stereo SXL6208.

When a composer is going, one day, to write something that will command universal attention, signs of originality are nearly always present in his earliest works. These often pay tribute to some

(Continued on Page174)

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

T. S. ELIOT: "The Family Reunion." Produced for the Theatre Recording Society by Caedmon Records. TRS308M (Mono 6 Sides).

"The Family Reunion" is a poetical drama set in a country house in the north of England, in which the course of action takes place in the one evening. The play has its parallel in the Greek drama, "Eumenides," by Aeschylus. The hero, Harry, is a man haunted by a sense of guilt; he dwells in a shadowy and terrifying world, pursued by the furies (he actually sees them), until he returns home for the family reunion.

Here the guilt is lifted from him by the revelation of the past—not his own past—but that of his mother and father. His father's desire to murder his mother has been projected into a belief that he himself has murdered his wife. The suffering of Harry and, to a lesser degree of Mary, the woman who had loved him unnoticed, and Agatha, an aunt who had loved and renounced his father, forms the core of the play.

Harry's mother, the somewhat larger than life dowager, Lady Monchensey, tries to dominate all around her, including her son, but eventually fails, as she has failed in all her human relationships throughout her life.

Invited along to join in the family reunion also are two aunts and two uncles who make inconsequential coversation; they are insensitive people who do not understand what is wrong with Harry, and have been torn reluctantly from their clubs and vicarage tea parties to participate in the drama.

Their voices are not easily distinguishable from each other and this is in keeping with their essential sameness and conformity of thought, and also the fact that they act in the manner of the chorus in a Greek drama commenting on the course of events. On this record the Greek chorus comes across with a stunning effect which is both awesome and disturbing. (In stereo this would be even more marked.)

This play has a direct relationship to T. S. Eliot's other works both poetical and dramatic, i.e. "Murder in the Cathedral," "The Cocktail Party" and "The Four Quartets."

Eliot himself supervised the casting of this recorded performance, which was completed the day before he died at the age of 76. In a way, then, this may be regarded as a definitive edition of how the author. who had a fine ear for the spoken word, thought the play should sound. Eliot, who was extremely self-critical, had doubts about some of the purely poetical passages. He felt that they were "too much like operatic arias," but it is this very poetical quality which helps to hold the listener's attention.

Paul Schofield, as Harry, who played the same role in the 1956 London stage production, captures every delicate nuance of Eliot's writing and speaks as a man who feels every word that he speaks. Dame Sybil Thorndike, who also played in the London production, more than fulfils the demands of the role of Lady Monchensey and there are two wonderfully sensitive performances by Dame Flora Robson, as Agatha, and Jill Bennett, as Mary.

Side 1 of the set requires careful listening in order to pick up the threads of the proceeding drama but, after this, there is no difficulty in following the complexities of the play throughout its 2¼ hours. Howard Saekler who directed the performance for the Theatre Recording Society, has realise the many dramatic possibilities of the play by making full use of modern recording techniques. Changes of studio acoustics and at other times close microphoning are used with great skill in helping to project this play's many moods and meanings.

"The Family Reunion" is not likely to be performed very often in this country, so this recording is a more than valuable souvenir of what J. B. Priestley has called "Eliot's finest play." Although not a play for everyday, it is one to which we can return to find something new on each occasion. Drama Societies might well consider this kind of performance as a reference point in the speaking of poetical dialogue.

The three records are attractively packaged in a box album with a well produced booklet containing pictorial material, an essay on the dramatist by John Gassner and a lengthy excerpt from Eliot's essay on "Poetry and Drama," all of which helps towards a better appreciation and understanding of this drama.

* * *

READINGS FROM C. J. DENNIS' "A Book for Kids." Reader John Clements. H.M.V. (Mono) Encore Series OELP9215.

On the evidence of this selection of short poems and two long stories, "A Book for Kids" has lost very little of its original charm since it was first published in 1921. While he had no children of his own, Dennis, as a writer, moved easily in the world of children, with no tendency to write down. Indeed, the poems in this album are largely a celebration of the enjoyment of life as a child might see it, i.e., "Our Street," "The Circus," "The Tram Man." I quote:—

"I'd like to be a Tram Man and ride
about all day,
Calling out fares please in quite a
'ficious way,
With pockets full of pennies, which
I'd make the people pay,
But on the hottest days I'd take my
tram down to the bay . . ."

Three of the poems reflect Dennis' love of picturesque words, "Cuppacumalonga," "Woolloomooloo," "The Triantiwontigongolope." The more picturesque they were, the better he liked them and, with considerable verbal dexterity, he wove them into this light-hearted poetry.

For the last 25 years of his life, C. J. Dennis spent most of his time at "Toolangi," his home in Victoria. Set amid tall trees, filled with the sounds of birds, "Toolangi" was the perfect place for a man who loved the sights and sounds of nature. This is reflected in the story, "The Little Red House," which is written in the form of a dialogue between a noble, century-old gum tree and the small house which is the home of a tinker and his wife. This touchingly told story has its exciting moments. too, particularly during the graphic description of a storm when the great tree nearly falls on the little red house, now temporarily deserted by its human inhabitants.

The other story, "The Boy Who Rode Into The Sunset," is not quite so much a tale of nature as a story from the world of the fantastic imagination—a fairy tale world. It tells what happens when a small boy who wonders what is beyond the distant horizon actually is given the opportunity to find out.

The reader on this album, John Clements, seems to me to tread a well-judged path between a little characterisation and a mostly straightforward reading, an approach which most children seem to appreciate. Mr Clements emerges from these readings as a pleasant personality rather like a favourite uncle who has dropped in to read a bedtime story.

Music and sound effects are used discreetly to add to the atmosphere of the stories and help in sustaining interest. The record is in an attractive envelope and, with Christmas not so far away, this is worth considering as a suitable present for a wide range of young listeners, who would enjoy these stories by one of Australia's most distinctive writers. ■

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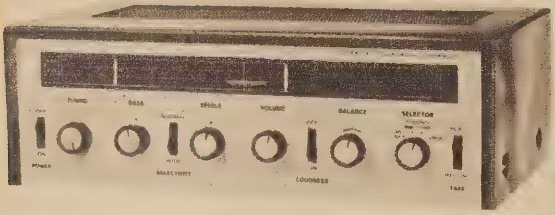

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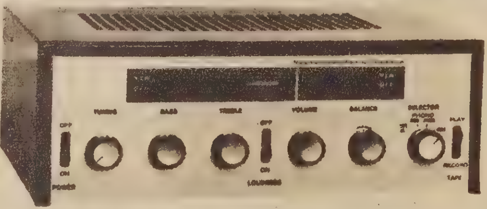

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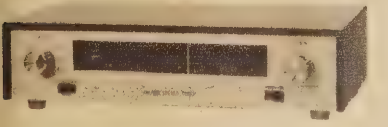

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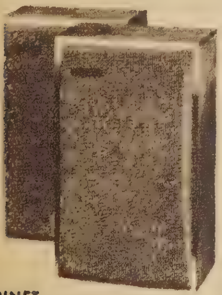

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Staff Review Panel

Devotional

HYMNS EVERLASTING. The Pete King Chorale. Stereo, Dot (Festival) SZL-931,977. Also available in Mono ZL-31,977.

Interest: Traditional hymns.
Performance: Good.
Quality: Good.
Stereo: Normal.

A graduate of the Cincinnati Conservatory and a product of the big-time radio era with the Al Goodman Orchestra, Pete King has had wide experience as composer, arranger and conductor for radio, records, television and motion pictures. This has taken in all types of music, often in association with the famous stars of the various media.

Here, with chorale, he turns his attention to famous and traditional hymns of the Church. His arrangements are built primarily on the conventional harmonies, sung with a mimimum of instrumental backing but embellished by super-imposed counter melodies and variations in tempo.

Overall, the presentation is reverent and tasteful, although, here and there, on side 1, I would have been happier without the soprano descant. This may be a personal reaction, however, and in other respects, the discipline and harmony is impeccable. In fact, the presentation and arrangements should be of special interest to those involved in church choirs of the more ambitious kind.

The hymns: Holy, Holy, Holy—Rock of Ages—All Hail, The Power—I Love To Tell The Story—Whispering Hope—Onward, Christian Soldiers—Stand Up Jesus—Just As I Am—What A Friend We Have In Jesus — Come Thou Almighty King—Faith of Our Fathers—Now The Day Is Over.

The surface of the review disc exhibited a trace of high frequency "prickle" but the quality and balance were otherwise excellent. (W.N.W.)

* * *

SOME GOLDEN DAYBREAK. Favourites New and Old, sung by Alan McGill. Accompanied by the Ralph Carmichael Orchestra. Stereo, Sacred LPS 6005. (Gospel Film Ministry.)

Interest: Fine Gospel baritone.
Performance: Outstanding.
Quality: Excellent.
Stereo: Not extensively exploited.

I have commented before on Alan McGill's fine baritone voice. He is one f those relatively rare singers who can fford to stand close-up on mic., with upport relegated well to the background. His diction is good, he never wanders off itch, he never sounds strained and his roduction remains smooth and steady. A professional singer until 1948, he now devotes his talents exclusively to Gospel music.

For the most part, the titles are well known but Alan McGill sings them so much better than most, that they take on a new quality: Some Golden Daybreak — Still Sweeter Everyday — I'd Rather Have Jesus—I Found The Answer—Face To Face—Show A Little Love—Each Step Of The Way—Sweet Hour Of Prayer—His Eye Is On The Sparrow—I Walk The Glory Road.

"He Will Walk Through The Valley With You" is mentioned in the notes as a first-ever recording but the one that took my fancy, and a new one to me is "He's Been There All The Time."

Technically the quality is right up to standard but the stereo counts for less than normal, mainly because Alan McGill dominates for most of the time from a firmly defined central position. But, as I said, with a voice like his, he can afford to!

One I can thoroughly recommend. (W.N.W.)

THE COVENANT GOSPELAIRES. Vocal, with Charles Magnuson at piano, Paul Mickelson, organ. Stereo, Supreme S-203. (Supreme Productions Ltd., Box 15, Footscray, Vic.)

Interest: Gospel quartet.
Performance: Thoroughly enjoyable.
Quality: Full and clean.
Stereo: Good separation.

This is a record which I thoroughly enjoyed and which I think you'll enjoy, too. The Gospelaires are good, though not in the sense that every note is ascetically in place; they are simply very human and very listenable.

Much of the credit, I feel, belongs to Charles Magnuson, arranger and pianist, and to Paul Mickelson, producer and organist. One provides embellishment at the piano, the other a solid foundation of organ bass.

The Gospelaires, incidentally, are dedicated laymen who have been singing together since 1952 and who now feature regular U.S. network Gospel sessions. Dave Boldt works for an electronics firm, Mel Anderson is a construction foreman, Evert Anderson is an elementary school principal and Bob Swanson a business man.

The titles: Heaven Came Down—How Rich Am I—He Set Me Free—Thou Wilt Keep Him In Perfect Peace—Sunset Is Coming, The Sunrise We'll See—His Name Is Wonderful—He, The Pearly Gates Will Open— Brighten The Corner—I Believe In Miracles—Yes, He Did—I'm Moving Up Home Some Day—There Is No Greater Love.

A record I recommend. (W.N.W.)

Instrumental, Vocal & Humour

EL AMOR BRUJO and EL RETABLO DE MAESE PEDRO (Manuel de Falla). First item played by L'Orchestre de la Suisse Romande conducted by Ernest Ansermet. Second item played by the National Orchestra of Spain conducted by Ataulfo Argenta. Ace of Diamonds (E.M.I.), stereo SDD 134. Also available in mono.

Interest: Spanish ballet and operatic works.
Performances: Definitive.
Quality: Very good.
Stereo: Normal spread.

This version of de Falla's ballet by the Suisse Romande conducted by Ernest Ansermet has always been highly regarded. It is, incidentally, the third time it has been issued; originally it appeared as a Decca release, then as a World Record Club disc, and now it has turned up under the "Ace of Diamonds" label.

Ansermet certainly brings out the sensuality and passion of this fiery music. Even the "Ritual Fire Dance," which I have never learned to like in its "concert hall" performances, takes on a new quality under Ansermet's baton. If you have not yet acquired this work in an alternative version, this one has much to recommend it, and it has the added advantage of being an economy priced label.

The "opera in miniature" on the reverse side is a curious work, and although it contains some fine music, it has never been popular. I believe this is due to the long periods of recitative which are used to describe the action of the puppet play. It never seems to occur

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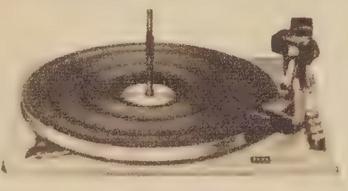

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Reader's Digest Album

120 GREATEST SONG HITS FROM BROADWAY. Ten-Record boxed set. Stereo, Reader's Digest, RCA Dynagroove. Also available in Mono.
Interest: Broadway song hits.
Performance: Consistently excellent.
Quality: Excellent.
Stereo: Excellent again.

The current emphasis by teenagers on their guitars and "pop" vocals has served to range in strong emphasis the tuneful melodies that have flowed from the Broadway stage during the past 40 or more years. Who among us doesn't have nostalgic memories of at least some of these romantic tunes?

In this 10-record set, "Reader's Digest" have collected 120 of them picked out of 80 or more shows, some very well known, others almost forgotten. Needless to say, they are too numerous even to begin to list.

The songs are arranged in sequence (and musically) so that they can be played in tandem on a record changer in which case, we are assured, they will provide six and a half hours of pleasant background music. However, all the numbers are separated into tracks, identified on the labels, identified on the jackets and cross-indexed in a separate folder. Browsing is therefore made easy and, if you want to pick out numbers and "turn up the wicks" the performances are well worth it.

The program is provided by a variety of orchestras under Hill Bowen, Wally Stott, Robert Mandell, Roland Shaw, Lee Roberts, Ronnie Ogden, Ken Thorpe, Alan Roper, Johnny Douglas, to quote a few of the names on the labels. And there's a similar array of vocalists and chorales. Fortunately, the result is variety, not confusion.

Technically the sound is first rate, with absolutely no surface noise and with excellent stereo spread and definition. Only in two or three spots could I pick any trace of "fuzz" in the 50 or so tracks which I sampled.

The packaging is a considerable improvement, to my mind, over the "book style" albums used for some of the earlier collections. Each disc has its own separate jacket, complete with notes, easily withdrawn from the box for inspection by individual listeners.

The review set came complete, by the way, with an extra "bonus" LP —"Broadway Show Stoppers." In every sense a companion disc to the other 10, it adds to the already outstanding value. (W.N.W.)

record companies that a translation the Spanish would at least allow e listener to follow what is going on ring the bouts of "talking."

The title "El Retablo de Maese Pedro" translated "Master Peter's Puppet ow," based on the famous incident in on Quixote" when the knight causes aos by attempting to rescue the fair msel and her lover from pursuing oors, although they are only puppets. you want this particular work, you e not likely to find a better version. e orchestra and singers are excellent, d the sound quality is very good, too, .A.T.)

* * *

HE WONDERFUL WALTZES OF TCHAIKOWSKY. Morton Gould conducting the Chicago Symphony Orchestra. RCA Dynagroove, Stereo LSC-2890.
Interest: Popular Tchaikowsky.
Performance: Rousing.
Quality: Excellent.
Stereo: Good even spread.

One does not usually associate haikowsky, with his reputed morbid ndencies, with the gaiety of the waltz. t these eight waltzes extracted from various full-scale works (and not, cidentally, written for social use, as re many waltzes of the Viennese mposers) show that he was quite capable of evoking the excitement and stle of the ballroom when occasion manded, in the process creating some his finest melodies.

Morton Gould and the Chicago Symphony Orchestra give these works a rousing performance and, if Tchaikowsky is your cup of tea, this disc is worth a trial.

Sleeping Beauty Waltz—Waltz from "Serenade for Strings" — Waltz of the Flowers, Waltz Finale and Apotheosis from "The Nutcracker"—Valse Bluette and Waltz of the Swans from "Swan Lake" — Waltz from Eugene Onegin. (H.A.T.)

* * *

FROM EUROPE WITH LOVE. Featuring Emile Belcourt, Roberto Cardinale, Julie Dawn and Janie Marden with the Europeans and Bobby Richards and his orchestra. World Record Club, stereo ST/4079.
Interest: Famous Continental songs.
Performance: First class.
Quality: Excellent.
Stereo: Restricted spread.

I have heard the currently popular song, "What Now My Love" on numerous occasions, sung in English, but it has never particularly appealed to me. As sung in French by Emile Belcourt here I enjoyed it immensely, and what I had previously thought to be a rather lifeless dirge seemed here to be vibrant with life and passion. Another very enjoyable number is "Mi'Lord" sung by Julie Dawn with impeccable accent. However, I only mention these two songs because they had particular appeal to me; in fact, I also enjoyed all the other songs.

All the 11 songs presented here are by French and Italian composers, and all have spread their fame throughout the world — in some cases known to English-speaking people only in the inferior translations. Here they are all sung in the original language in sparkling arrangements which, to my mind anyway, give them greatly increased stature. The singers are all very good, too.

In all, the album is well conceived and splendidly executed. The sound quality is excellent, although the stereo spread is very restricted. (In fact, I looked at the label to make sure it was a stereo record at one stage.)

The titles: Quando, Quando—Non Ho L'Eta Per Amarti—Et Maintenant—Je Ne Regrette Rien—Il Nostro Concerto —Mi'Lord — Volare — Al Di La—La Novia—Jamais le Dimanche—Romantica. (H.A.T.)

* * *

DANCING WITH TENOR SAX. Satoru Oda and his Group. Festival, Stereo SFL-931,973. Also available in Mono, FL131,973.
Interest: Dance music, strict tempo.
Performance: Good.
Quality: Excellent.
Stereo: Excellent spread.

This disc arrived at the same time as the "Los Indios" disc reviewed last

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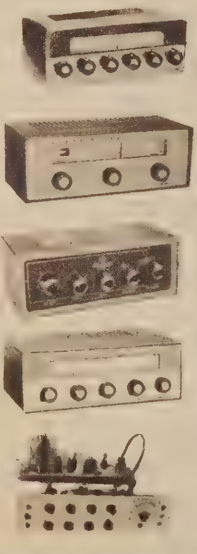

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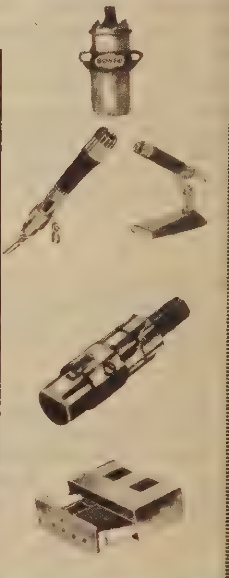

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CLASSIC ORGAN

THE CATHEDRAL BACH: Edouard Commette at the organ of the Cathedral of St. Jean de Lyon. World Record Club 12in stereo, ST-4070.

Interest: Classic Organ. Recording: Excellent.
Performance: Full of grace. Stereo: Smooth, subtle.

An immensely enjoyable recording of major Bach organ works from the undisputed doyen of French organists, the 83-year-old Edouard Commette. And, as one would fully expect, he is playing the organ at which he has played officially for the past 62 years—that of the Cathedral of St. Jean de Lyon.

I write that the recording is immensely enjoyable not simply because it is of Bach organ music (although I must confess an initial bias in this direction!), but because M. Commette plays with a grace and elegance which must surely rank this performance high among other recordings of these works. To my mind, his playing here is far better than that of the others of his discs in my collection; a credit to his age and a testament to his experience and ability. In particular, he seems to have outlived a past tendency toward over-registration, achieving now a remarkable clarity and tonal balance.

For those unfamiliar with the organ of St. Jean de Lyon, it is a three-manual instrument in the best classical tradition. It was first installed in 1841 with only 15 stops, but has been added to and rebuilt since then to give the present complement of 50 stops. It is very well suited to the playing of Baroque music and Bach in particular.

The works played by M. Commette on this occasion are the tremendous B minor Prelude and Fugue, BWV 544; the less weighty but no less enjoyable G minor Prelude and Fugue, BWV 535, written when the composer was in his early 20s; the much later "Dorian" D minor Toccata and Fugue, BWV 538, a most powerful and mature work; and the lesser-known C major Toccata and Fugue BWV 566.

The Columbia recording is of excellent quality in all respects, with negligible distortion and surface or tape noise. Thus I have no reservations in giving the disc my full recommendation, particularly to those seeking a good recording of the B minor or D minor works.

A credit to a grand old organist. (J.R.).

nonth in these columns. In style and xecution it is remarkably similar; in act, one could almost visualise that these re the same performers playing differnt instruments.

There is the same leisurely approach, he same relaxed style, but here the ead is taken by a tenor sax, and the ccompaniments are provided by a typial small instrumental group. While the ax player may not be in the same class s Billy Vaughn, he nevertheless plays vell, and again the sound quality and tereo are first class. The group plays n strict tempo throughout, so this would e a good disc for dancing.

Old favourites and present-day hits re both featured in the titles: My Melancholy Babe—I'm In The Mood or Love—The Girl From Ipanema—Ay Blue Heaven—The End Of The World—More—All Of Me—Just Say I ove Her—East Of The Sun—Red Roses or A Blue Lady—Everybody Loves omebody — Goodnight Sweetheart. H.A.T.)

* * *

IG HITS FOR SWINGERS. Ray Ellis and his Orchestra. Festival, Stereo SAL-931,970. Also available in Mono, AL-31,970.

Interest: Big band performances of popular tunes.
Performance: Lively.
Quality: Excellent.
Stereo: Normal spread.

Those who like their tunes played vith lots of noise in the brash merican swing band style will find this isc to their liking. The tunes are all ery popular at the moment and played, s here, by a large group of America's op-flight musicians, they sound very vely and exciting.

Despite the generally loud sound evel, there is no evidence of distortion, n my equipment at any rate, and the ereo is also well arranged. Definitely not for those who like a quiet life, but sure to be a hit with those who like plenty of enthusiasm in their music.

A run through the track titles will show why the title includes the term Big Hits: King Of The Road—Yesterday—Hang On Sloopy—(I Can't Get No) Satisfaction—I Feel Fine—Ferry Across The Mersey—I'll Never Be Lonely Again—Flight To Mexico—Portrait Of Jan—1-2-3—I Got You Babe—Wait Till We're Sixty-five. (H.A.T.)

* * *

NOREEN HENNESSY Plays The Prince Edward Theatre Organ. Stereo, Tosa, DRX 5553. (Tosa Records, 10 Caloola Road, Wentworthville, N.S.W.)

Interest: Final recital.
Performance: Capable.
Quality: Reasonable.
Stereo: Useful spread.

I am indebted to Mr John Clancy, secretary of the Theatre Organ Society of Australia, for this recording of Noreen Hennessy's farewell recital from Sydney's now demolished Prince Edward Theatre. Installed in 1924, when the theatre was built, the organ was credited with "sweeter" voicing than other Wurlitzers, which followed it into Australian theatres.

Now owned by the Theatre Organ Society, it is being installed in the Marrickville (N.S.W.) Town Hall. A note on the cover indicates that all proceeds from this recording are to aid the project.

The program has a neo-classical flavour: Danny Boy—Gaite Parisienne Suite—Trieste Overture—Spanish Gypsy Dance—William Tell Overture—Australian Maid—Play Gypsy and Czardas—The Misere Scene from Il Trovatore—Clair de Lune.

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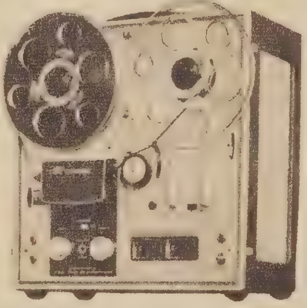

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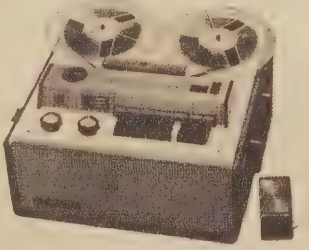

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ably, though baulked at times by tec nical faults in the instrument, whi defied the Organ Society's all-nig effort at first aid.

The recording quality I can only r as "reasonable." There is a fair amou of tape hiss behind the sound, wi abrupt periods of silence between track I was conscious also of faint but hig pitched modulation in the noise, th could have come from the org pneumatics or from the tape system self.

However, while the overall presenta tion falls short of the most recent org imports, it is nevertheless an adequa momento of an occasion significant followers of the Wurlitzer style orga I imagine that many will want it that account. (W.N.W.)

* * *

THE DOWNTOWN SCENE — Nin pinta and his bongos and cong Festival 12-inch stereo, SDL-931,8 (Also in mono, on DL-31,856).
Interest: Latin-American dan music.
Performance: Bright, rhythmic.
Recording: Excellent.
Stereo: Widely spread.

Sub-titled "Hits For The Hip," th disc marks the recording debut of young Virgin Islander—Ninapinta—w was recently "discovered" in Philadelph when performing at a small jazz clu His specialty is the bongo and con drums, and he plays them as if th were almost part of himself. On th disc he teams with an unnamed p group to present twelve current hits interpreted in his distinctively Lati American fashion; it makes exciti listening indeed.

The tunes are: Help — I Can't He Myself — Hang On Sloopy — Stop The Name Of Love — Mrs Brow You've Got A Lovely Daughter Satisfaction — The "In" Crowd You've Got Your Troubles — A Love Concerto — 1-2-3 — It Ain't Me, Bal

The recording and stereo are excelle (J.R.).

* * *

A BUCKINGHAM SPECIAL. V Hammett, Wurlitzer Pipe Orga Stereo or mono, Concert Recor ing CR-0006. (Concert Recordin 10 Caloola Road, Wentworthvil N.S.W.)
Interest: Pipe Wurlitzer.
Performance: Good.
Quality: Good.
Stereo: Average.

As did the Noreen Hennessy recor ing, reviewed elsewhere, this one ca to me from Mr John Clancy, Secreta of the Theatre Organ Society of Au tralia.

The Society's interest in the recordi is not hard to fathom, since it is of large composite instrument, assembl from various discarded theatre orga and installed in the Buckingham (En land) Town Hall, by members of t Theatre Organ Preservation Society. parallels the efforts of the Australi Society in transferring the old Prin Edward theatre organ to the Marric ville Town Hall.

The jacket notes describe the org and give a brief biography of the arti Vic Hammett who, incidentally, is cu rently musical adviser to Livingsto Burge Electronics—manufacturers of excellent range of electronic instrumen

The program is typical middle-of-th road theatre organ material, played qually typical style: Song Of Alassio —Can't We Talk It Over?—Horse Box —A Nightingale Sang In Berkeley quare—Ecstasy—Somewhere A Voice s Calling—Golden Earrings—Stay As weet As You Are—I Can Give You he Starlight—Along The Navajo Trail —How Are Things In Glocca Morra? —Caravan.

Incidentally, the recording is an Ame- ican pressing and described as "Stereo- lex"—capable of being played either as ull stereo or on a mono player. What- ver tricks may have been pulled to in- ibit damage from non-compliant mono ickups, the stereo is of quite acceptable rder and the quality is likewise normal.

Another interesting disc for popular ipe organ followers. (W.N.W.)

* * *

ICHELLE, Bud Shank, Festival Records, Stereo SFL-932, 925. Also available on Mono.

Interest: Alto Saxophone.
Performance: Tasteful.
Quality: Very good.
Stereo: Normal Spread.

Here is a most delightful album, full f beautiful melodies interpreted in a ost sensitive fashion by Bud Shank n alto and Chet Baker on flugelhorn.

Paul McCartney and John Lennon are he composers of the title piece— Michelle"—which in my opinion is the est popular melody to emerge since ancini's "Moon River."

Their "Yesterday" is also included, and ome of the other titles are Sidney echet's "Petite Fleur," Mick Jagger's As Tears Go By" and the theme from Umbrellas of Cherbourg."

Arrangements are by Bob Florence, nd a quiet and peaceful beauty per- eates the entire album. (G.B.)

* * *

HE VOICE OF THE VIOLIN. Derek Collier, violin, with Ernest Lush, piano. H.M.V. (E.M.I.) mono OXLP.20080.

Interest: Light classics for violin.
Performance: Unpretentious but pleasing.
Quality: Good.

English violinist Derek Collier here resents a collection of pleasant snippets or solo violin and piano accompani- ent, none of which require any great oncentration and, in general, put no reat strain on the performer. However, few pieces do require skill of a high rder and, in these pieces, Mr Collier hows that he is a very competent player deed, although he eschews any sus- icion of flashiness in his style. Ernest ush contributes a faultless, if rather rosaic, accompaniment throughout.

The program includes original works r violin as well as arrangements of orks written for other instruments. mong this latter group I would par- cularly mention the lovely G flat Im- romptu of Schubert (surely one of the ost sublime melodies ever written), iginally composed for piano, but unding just as beautiful in the violin rangement.

Most of the other pieces are com- ositions of the second half of the nine- enth century, which we may broadly assify as "late romantic" in style. me of the composers are little known, t the recital as a whole makes easy stening. The titles are:

Banjo and Fiddle—Estrellita—Liebe- id — Gweedore Brae—Canzonetta— npromptu in G flat—El Campielo—

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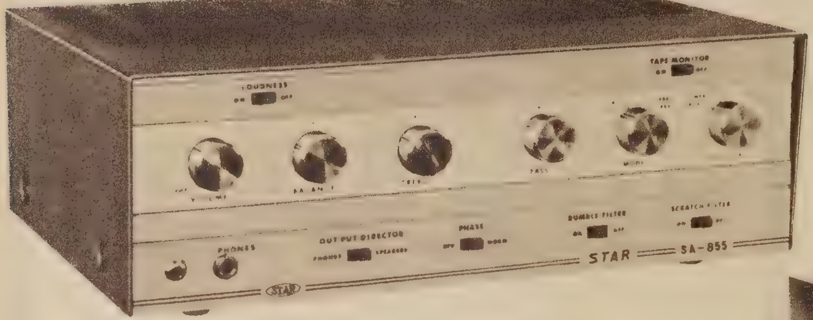

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ance of the Marionettes—La Fille au neveux de Lin—Serenata Napoletana - Songs My Mother Taught Me — In hree-four Time—Melody—Andaluza—oe Down. (H.A.T.)

★ ★ ★

ENNARIO PLAYS CHOPIN FOR YOUNG LOVERS. Leonard Pennario. Capital (E.M.I.) stereo SP.8626. Also available in mono P.8626.

Interest: Popular Chopin.
Performance: Competent.
Quality: Good.
Stereo: Insignificant.

I feel that E.M.I. is entirely right to m this recital at the younger generaon just "discovering" Chopin rather an the experienced listener who has ready been well catered for in the cellent E.M.I. disc, "Great Pianists ay Chopin," reviewed in our July sue.

I say this because all the pieces presnted by Leonard Pennario here are om that group of Chopin's compoions which first attract the attention young people and interest them in assical music. Moreover, I feel that it no accident that nearly every Chopin ne that has been popularised by song riters appears in this list: Etude, Op. , No. 3—Fantaisie Impromptu—Nocrne, Op. 9, No. 2—Polonaise in A at—Preludes in A major, C minor, D t and E minor—Waltzes, No. 3 in E inor, No. 7 in C sharp minor, No. 9 A flat and No. 12 in F minor.

Pennario plays very competently ithout "Schmaltz" and excess rubato voured by some pianists, yet also anages to avoid the clinical detachent found in the interpretations of me other players. Sound quality is nerally good, but I fear that some der recordings have been incorporated. d "electronically rechannelled" for ereo. Still, stereo separation plays no nportant part of solo performances, so is must not be taken too seriously. I.A.T.)

★ ★ ★

N MEMORIAM. Volume 2. Kathleen Ferrier, contralto. Decca (E.M.I.) mono only, LXTA 7512.

Interest: Reissue of recordings by famous singer.
Performance: Perfection.
Quality: Dated.

The death of English contralto Kathen Ferrier in 1953 at the age of 41 as a musical tragedy of the first order. iss Ferrier's rise to fame was meteoric y musical standards, since she rose om complete obscurity to the top of her ofession in ten years. Unfortunately, iss Ferrier did not make many recordgs in the days of 78 rpm, and the P. disc was still in its infancy as a mmercial proposition at the time of r death, so recordings by this great tist were lamentably few.

However, these few recordings have least preserved for posterity the marllous qualities of her voice, so that ture generations will be able to listen d marvel, as did those of her own neration.

In this recording we have a good reesentative selection of Miss Ferrier's t, including traditional songs, a Geran lied, and extracts from opera and atorios: Ye Banks and Braes — O, aly Waly—Now Sleeps the Crimson tal—Drink To Me Only With Thine es—I Will Walk With My Love—illow Willow — Ma Bonny Lad — eistichliches Wiengenlied—Mad Bess Bedlam — Grief For Sin (from the Bach "Mass in B Minor")—Art Thou Troubled (from Handel's "Rodelinda") —Che Puro Ciel (from "Orpheo and Euridice" by Gluck).

This is the second Kathleen Ferrier disc to be released recently under the title "In Memoriam" and if the intention is to reissue every one of her recorded works in this series, Decca will have earned the gratitude of all music lovers. Please! (H.A.T.)

★ ★ ★
★ ★ ★

HAWAII TODAY. Soloists and chorus of the TV and radio show "Hawaii Calls." Capitol (E.M.I.), Mono T 2449. Also available in Stereo, ST 2449.

Interest: Modern Hawaiian music.
Performance: Unhurried, idyllic.
Quality: Very good.

The artists featured on this disc are members of a radio and television show called "Hawaii Calls" which is very popular in U.S.A. but which, as far as I know, has not been shown or heard here. The group taking part consists of a chorus of 16 with various soloists and instrumentalists from the show.

The traditional style of Hawaiian music has been largely submerged in the American influence, but the dreamy, idyllic character of Hawaiian music is still retained. Most of the numbers are vocal, with instrumental accompaniment, and naturally the Hawaiian guitar plays a big part in all the arrangements. There are also three purely instrumental numbers.

The songs selected for this disc include new numbers as well as some of the established favourites, but there are none of the familiar traditional melodies such as "Aloha Oe" or "Sweet Leilani." If these are what you want, you will have to look elsewhere.

The 12 track titles are: I'll Remember You—Sands Of Waikiki—Pearly Shells—Sweet Someone—(There Goes) Kealoha—Beyond The Rainbow—Painted Sands—Ho-Le Waimea—Hasegawa General Store—Hawaii Tattoo—Quiet Village—Oceans Away." (H.A.T.)

★ ★ ★

WAY UP FROM DOWN UNDER. Lyn and Graham McCarthy. Columbia (E.M.I.), Mono 330SX-1765.

Interest: Australian folk singers.
Performance: Pleasing.
Quality: Excellent.

Lyn and Graham McCarthy are comparatively new to the entertainment world, but I am sure they have a very successful career ahead of them, to judge by their singing on this disc, which I believe is their first LP. They sing very melodiously in the quiet style typical of Nina and Frederick (as opposed to the intense style of Peter, Paul and Mary, for example). Their guitar playing is also nicely executed, while Graham McCarthy's arrangements exhibit a commendable degree of musicality.

I enjoyed this disc immensely, and I can recommend it to those who find pleasure in folk singing. Australians who are a little tired of the usual repertory of imported material will find additional enjoyment in the largely Australian content, which includes a composition by Graham McCarthy himself and several traditional songs, as well as an Anglicised version of an Aboriginal lullaby sung to an accompaniment of Mulga sticks struck together.

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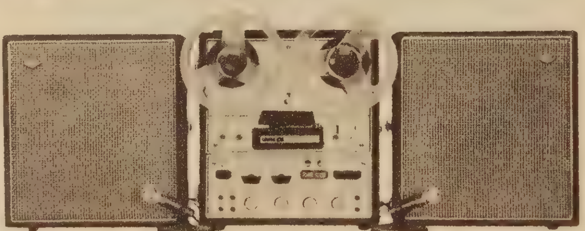

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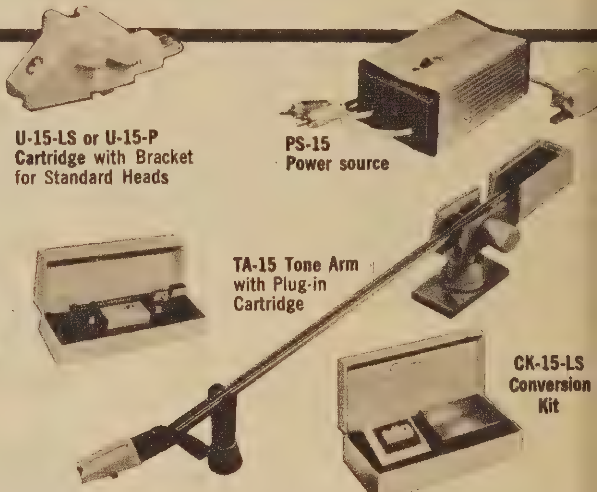

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Track titles are: Seven Doves (Mc- arthy) — The First Time (McColl) — he Times They Are A-Changin' — lamma Warrano (Trad.)—A Thousand liles Away (Trad.)—Wild Colonial Boy Trad.)—The Overlander (Trad.)—The onnie Lass of Fyvie-o (Trad.) — Hush ittle Baby (Trad.) — Out After Ale Trad.) — Across the Blue Mountains Trad.) — Fare Thee Well (Gude). — H.A.T.)

* * *

N THE MOOD, The King Sisters. Camden (RCA) Stereo CAS-929. Also available in Mono on CAL-929.

Interest: Nostalgic.
Performance: Excellent.
Quality: Very good.
Stereo: Poor.

This disc features a collection of well- nown performances by the King Sis- rs, originally recorded in the late irties and early forties. The harmonis- g by this group is excellent and the nes presented range from the mellow weet to solid bounce. The orchestral acking for the King Sisters is good, nd old and new fans alike will find uch to enjoy in the album.

The 10 numbers: In The Mood— weetheart of All My Dreams—Ac-cent- hu-ate The Positive—Cielito Lindo— ake Me In Your Arms—Oh, How I liss You Tonight—Back In Your Own ackyard—Music Makers—I Came ere to Talk For Joe—Moonglow.

Considering the age of the original cordings, RCA engineers have done excellent job, although the "repro- essed" stereo could offer only minor dvantage over the straight mono ver- on. (K.W.)

* * *

MMY LITTLE SINGS THE COUNTRY AND WESTERN GREATS. Featuring the Jimmy Little Trio. Festival, Mono, FL-32,000.

Interest: Popular Aboriginal singer.
Quality: Good.
Performance: Pleasing.

Australian aboriginal entertainer mmy Little, accompanied by his trio guitarists (also Aboriginal) here pre- nts a round dozen of some of the st-known country and western songs: onesome No. 1—Born To Lose—The al Who Invented Kissing—Still—I eally Don't Want To Know—Take ood Care of Her—I Can't Help It— Can Mend a Broken Heart—Treasures ntold—There Wasn't An Organ at Our edding—Little Ole You—El Paso.

Jimmy has established quite a repu- tion as a singer, and those who like untry and western songs will no doubt ree with me that this disc is as good any of the imported material cur- ntly being placed on the market in rge quantities, both in terms of con- nt and technical quality. (H.A.T.)

* * *

EARTBREAK TRAIL. A tribute to the Sons of the Pioneers presented by Hank Snow. RCA, Stereo LSP-3471. Also available in Mono on LPM-3471.

Interest: Country and Western.
Performance: Good.
Quality: Very good.
Stereo: Normal.

This record presents a selection of ngs that the Sons of the Pioneers ve featured in past years. Hank ow's performance of these popular stern songs is good and the orchestral backing leaves little to be desired. This type of record will not appeal to everybody but country and western fans will appreciate the grouping of these evergreens on the one disc.

The songs presented are: Tear Drops in My Heart—Ridin' Home—Heart Break Trail—Cool Water—Tumbling Tumbleweeds—At the Rainbow's End —The Texas Plains—Chant of the Wanderer—On the Rhythm Range—Following the Sun All Day—The Wayward Wind—Pantanio, the Pride of the Plain.

One that should appeal to a defined audience. (K.W.)

* * *

AUSTRALIAN COLONIAL BALLADS. Vol. 1. The Catalpa Singers. Mono, Crest CRT-12-LP-012. (Sound and Film Enterprises of Aust. Pty. Ltd., 291 Tooronga Road, Tooronga, SE6, Vic.)

Interest: As per the title.
Performance: Authentic enough for this reviewer.
Quality: Slight "edge."

A notable aspect of recent interest in folk music generally is the emergence of distinctly Australian folk songs, with their emphasis on deportation, convicts, bushrangers, swaggies and other such colourful features of our early history.

I personally can't take too much "authenticity" in this kind of thing, where it means simulated (sometimes, I fear, actual) rough bush voices, gross liberties with the pitch and so on. Surely there must have been a few good voices in the old colonial days!

The Catalpa singers, most of whom are trained musicians, according to Hugh Anderson's jacket notes, steer a suitably middle course, as far as I am concerned. They inject plenty of the old bushman's twang into the singing, but keep pitch and tempo reasonably under control and give it an instrumental backing that belongs more to this century than the last.

The numbers are all drawn from Hugh Anderson's book, "Colonial Ballads," 3rd Edition: Click Go The Shears—The Black Velvet Band—The Old Bark Hut—Bold Jack Donahoe—The Eumarella Shore—Bound For South Australia—The Wild Colonial Boy—The Overlander—Look Out Below—The Death Of Ben Hall—With A Swag On My Shoulder—Botany Bay.

Well worth a hearing by those interested in these "Colonial Ballads." (W.N.W.)

* * *

DEAN MARTIN HITS AGAIN. Dean sings with Ernie Freeman as arranger and conductor. Reprise Stereo RS6146.

Interest: Popular songs.
Performance: Fair.
Quality: Good.
Stereo: Well spread.

To this reviewer the overall performance on this disc seemed to fall short of what might be expected from such a well-known artist. The orchestration itself is excellent but it competes with, rather than supplements, the vocal. And yet this may not be without intent, for one gets the feeling that the vocalist has to strain to cover the range set by some of the numbers:

You're Nobody 'Til Somebody Loves You—I'll Hold You In My Heart—Have A Heart—My Heart is an Open

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Total Harmonic Distortion at rated power 0.5%
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Frequency response plus/minus 2 db 10-100,000cps
Signal for rated power output
Mag. Phono at 1 KC (Standard RIAA) Equalisation 2mv
Tuner Input .. .. 100 mv
Tape (RCDR) Input .. .. 100 mv
Tape Output .. .. 100 mv
Min. recommended load resistance on tape out .. .. 25k ohms
Speaker Output Impedance .. 4, 8 and 16 ohms

Hum and Noise:
Signal to noise ratio (loudness control at min.) .. .. —80db
Tuner Input .. .. —78db
Tape (RCDR) Input .. .. —78db
Mag. Phono (Standard RIAA) .. —55db
Stereo Separation (at 1 kc)
Phono Magnetic 65db
Tuner 65db
Tape Input 65db
Tone Controls:
Treble at 10 kc .. 10db boost: 15db Cut
Bass at 50 cps .. 15db boost: 15db Cut
Contour: Up to 10 o'clock .. max. 5db boost. at 50 cps
Past 10 o'clock .. .. response linear
Range of line voltage .. 220-240 Volt, 50 cps.
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Idling .. .. 10 Watts
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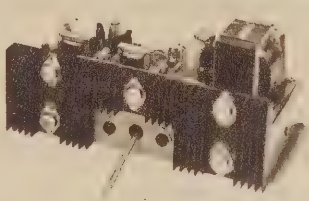
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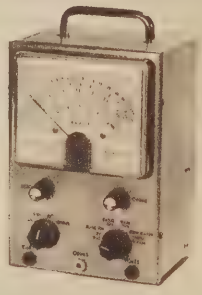
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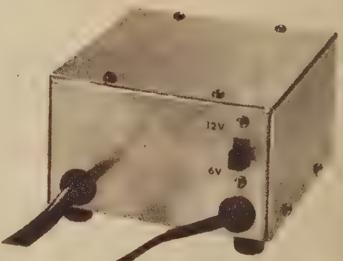

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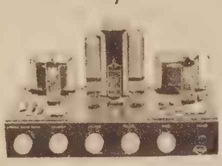
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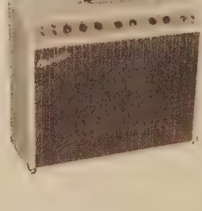
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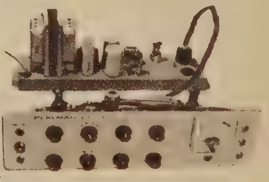
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ɩook—You'll Always Be the One I ,ove—Send Me The Pillow You Dream)n—In the Chapel in The Moonlight— end Me Some Lovin' Wedding Bells— 'll Be Seeing You.

Mainly for Dean Martin fans. (K.W.)

* * *

'HE IRISH ALBUM. Neva Eder. Viking (E.M.I.), Stereo, VSP 197. (Available as Mono VP 197.)
Interest: Irish songs.
Performance: Sympathetic.
Quality: First class.
Stereo: Not noticeable (solo performer).

Here is another Irish album to join ıe spate of similar records which have een released lately, this time by up and oming New Zealander, Neva Eder. Aiss Eder sings well enough, with a leasant voice containing just a touch f brogue, although she was born in lew Zealand and has lived there all er life.

The sound quality is very good, and ıst a touch of reverberation is used to ive presence, but I was puzzled by sudlen increases in volume here and there. eventually concluded that Miss Eder ings within a very restricted dynamic ange, and the recording engineer may ave been trying to help out by juggliɡ the volume control. As in all cases here a single performer is featured, the ereo spread is not significant.

All the songs will be known to those 'ho have more than a passing acquainınce with Irish folk songs: Spanish ady—Come Back Paddy Reilly— leaven Around Galway Bay—Ach, I)unno—Danny Boy—Spinning Wheel— rish Jaunting Car—Oft In the Stilly light—The Frog—If You Ever Go To reland—My Love He Lives In a Castle -Bonny Boy. (H.A.T.)

YOUR GRAMOPHONE

Continued from Page 119.

unduly high capacitance cable may reduce overall output voltage.

The most common "non-standard" connection that may crop up is that a high impedance cartridge may be required to feed into an amplifier only having an equalised "magnetic" input. However, the makers of modern ceramic cartridges have anticipated this situation and, provided their instructions are followed to the letter, the bass loss due to the low impedance load will just about change the response into the velocity response of a magnetic pickup: and the volume loss, too, can be arranged to bring the relatively high output voltage down to that of an average magnetic pickup.

By the way, the approximate voltage sensitivities I have given above for each type of pickup assume that the pickup is loaded with the appropriate impedance. They are also specified by the manufacturers for a standard recorded signal strength. This is usually a recorded velocity (at 1,000Hz) of 1 centimetre per second in this country (Britain) and 5.5cm/sec in the U.S.A. The levels in music recordings are about 10 times the U.K. level in practice, with peak velocities reaching about 30cm/sec.

So far we have mainly concentrated on the electrical aspects of pickups, but many of the problems in setting up and using pickups are concerned with the relationship between stylus and groove. We shall discuss this, for mono and stereo, in the next instalment.

(To be continued.)

POPULAR JAZZ

By GRAEME BELL

ɛLLY ROLL MORTON: HOT JAZZ, POP JAZZ, HOKUM AND HILARITY. RCA Vintage Series. Mono LPV-524.
Interest: Vintage Jazz.
Performance. Very professional.
Quality: Good remaster.

An excellent collection of 16 Jelly oll Morton tracks, on which you can ɛar some of the novelties and gimmicks e early jazz bands used to get their usic across.

For "Hyena Stomp" and "Billy Goat omp" Mr Morton hired an animal imitor by the name of Lew Le Mar, and r some of the other tracks, Wilton 'awley, a vaudevillian who plays laughɡ clarinet.

Add to this the smacked-note clarinet George Baquet, with the always high ındard of hot jazz musicians Morton ıs in the habit of assembling, and you ve some most exciting and entertaining ısic.

The personnel includes some of the ɛat names in jazz, such as George Mitɛll, Red Allen, J. C. Higginbotham, Pops Foster, Charlie Holmes and The Dodds Brothers, to name but a few, and the cover notes written by jazz historian Charles Edward Smith are a sheer joy.

Much intelligent thought has gone into assembling this first-class album of hokum and hilarity. I might add that the use of novelty and comedy when presenting jazz is just as useful and sometimes essential today as it was in 1929.

* * *

KEN COLYER'S JAZZMEN: OUT OF NOWHERE. H.M.V. Folk and Jazz Series, Mono OXLP-7509.
Interest: New Orleans Jazz.
Performance: Varied.
Quality: Fair.

This is the English brand of New Orleans style jazz, for which trumpeter Ken Colyer is now world famous.

Brought out to Sydney in December, 1963 by The Australian Jazz Convention Committee, Colyer is probably one of the most sincere musicians playing this sort of music today.

No time restrictions have been imposed, which leaves the band plenty of room for that gradual build-up in tension so essential to New Orleans Jazz.

One cannot understand, however, why in order to qualify for this re-created style one must have the clarinet out of tune, and a general degree of musical incompetence all round!

Since the same can be said for all New Orleans style music being played today, it would seem that these are essential "qualities," and so it is difficult for me to take this album seriously. ■

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FEATURES:
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TECHNICAL DESCRIPTION:
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OdB = 1 Volt per Microbar.
RTMA Microphone Rating Gm: (sensitivity): ÷ 159 dB.
RTMA Standard SE-105.
Hum Sensitivity (RTMA) GH: ÷ 153 dB.
Output impedance:
Nominal at 1,000 c/s: 150 Ohms.
Rating Impedance: 150 Ohms.
Size: 10 3/8in x 1 3/16in.
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Tone control	Minus 20DB at 10KC	"
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Noise	Minus 60 DB	"
Inputs	1 microphone/ 1 pickup	"
Provision for	50 ohm Input	"
Output impedance	100V Line (330 ohms)	"
Regulation	3 DB	"
Valves	Two 12Ax7 Two 6DQ6B	"
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TRADE REVIEWS AND RELEASES

'Miracord 50H" Transcription Changer

A record changer of transcription quality with just about every possible facility: This is how we would summarise the new Elac "Miracord 50H" transcription turntable, a sample of which has been submitted for review by RCA of Australia Pty. Ltd.

A few years ago it was regarded as ipracticable to produce a record changer ith a performance warranting any sort comparison with the manual transcription pe playing deck. The Elac company has obably done as much as any to reconcile e conflicting requirements of changer echanisms, while achieving orders of mble and wow and flutter low enough satisfy the discriminating listener. This test turntable from Elac seeks the ultimate operating convenience, while retaining e performance characteristics of the anual transcription type units.

The new model is basically the same as e earlier "Miracord 40," which has been ailable for a year or so, but has more cilities; a number of refinements have so been incorporated. Otherwise it follows e same pattern—pressed steel baseplate ith pliant mounting feet at each corner; eavy non-magnetic alloy turntable driven y a rubber-tyred idler wheel and stepped ulley attached to a large hysterisis synronous motor; dynamically balanced tone m with stylus weight adjustment, by calirated dial in this new model.

The unit is finished basically in matt ack and brushed chrome, with a few ms finished in bright chrome. If it is be criticised in terms of appearance, it uld be on the basis of being unduly nservative.

It is clear from a study of the facilities ovided with this deck that the Elac signers have considered every possible quirement of the user, and have attempted cater for these requirements.

Operating controls consist of speed ange lever for the usual four playing eeds, which is very smooth and positive; ree starter buttons, one for each of the ndard disc sizes, which serve the dual rpose of starting the playing cycle and suring that the stylus comes down at the rt of the disc (provided you push the ht button); and a stop button, which ables the playing cycle to be interrupted any point.

In addition there is a "cueing device" etter called a lowering device) which is d for setting down the stylus anywhere a record surface or for lifting it off thout damage to grooves.

Two centre spindles are provided, a short e for manual operation and a longer anger-type spindle for those who wish use the automatic changer facility. This indle is of the "umbrella rib" type which understand was originally developed by ac, and is now used in many high quality nscription changers.

Reversing the shorter manual spindle in centre hole brings into operation the utomatic repeat" facility which enables ecord to be replayed a number of times. the end of the playing cycle the tone n, instead of returning to the rest position, es back to the beginning of the record. peats will continue indefinitely, until the p button is operated, or the arm is rked manually.

The player can be operated entirely manually, or as an automatic single-play deck, or as a fully automatic changer.

For manual operation, it is only necessary to lift the tone arm off its rest to start the motor. The lowering device can then be used to set the stylus down on the disc. For single play automatic use, pressing one of the start buttons will start the playing cycle. In either case, the stop and arm parking mechanism at the end of each playing is automatic.

When used as an automatic changer, the discs are stacked on the changer spindle and the player started as before by pressing the right starter button, corresponding to the size of record being played.

It should, however, be noted that this player has no sensing mechanism which will enable it to distinguish between different sizes of records, so it will not cater for stacks of records of mixed sizes, as some players will. To start the player it is necessary to push one of the start buttons, and as explained earlier, there are three such buttons, marked for the three sizes of records.

The onus is on the user to ensure that when the machine is started, the stylus will come down at the right place for the size of record to be played. If he loads his player with 7in discs and presses the 12in start button, his stylus could come to grief on the rubber mat. Conversely, if he loads with 12in records, and pushes the 7in start button, he will hear only the last few tracks of each disc.

The start and stop buttons are very light to the touch and can be operated without the slightest jar being transmitted to the arm. Thus, even when playing with very low weight on the stylus there is no risk of causing the stylus to bounce on the record surface when operating these controls.

To prevent the turntable from spinning too long at the conclusion of the playing cycle, a braking system comes into operation as soon as the tone arm returns to the rest position. A muting switch is also incorporated, which does not operate until the stylus is on the record, thereby preventing noise from contact arcing on the motor switch from coming through the amplifier.

The 8in long square section metal arm is rather short for a high quality unit, but the manufacturer's literature says it has been specially designed for high rigidity and freedom from resonance over the whole range of audio frequencies, and we must assume that they know what they are doing.

The head shell is made from resonance damping plastic, and is in two parts. The rear section is permanently attached to the tone arm, while the front section containing the cartridge clips into the rear section. A firm pull toward the front is all that is required to withdraw the front section for changing the stylus or cartridge. Replacement is just as easy, since guide grooves are provided to ensure that the head is properly located. A gentle push locks the shell into position. With this method of connecting the tone arm to the head shell, no special attachment devices are required.

Setting the playing weight is accomplished by the now standard method of adjusting the counterweight until the arm is in a state of balance, then applying the required amount of weight by means of an auxiliary calibrated adjustment. However, the refinements incorporated into the Miracord system are worth mentioning, as they make the job that much easier.

Movement of the counter weight is controlled by a small knurled knob attached to the counter weight which is coupled to a small rubber-tyred roller inside the weight. This bears on the arm section and moves the weight by friction. While this arrangement is not as positive as we would have liked, and exhibited a certain amount of backlash, we did find it fairly easy to balance the arm.

Playing weight is then applied by means of a supplementary adjustment on the arm, calibrated in half-gram divisions from 0 to 6 grams. This must, of course, be set to the zero mark before adjusting the main counterweight. The method of operation of this adjustment is not clear, but presumably it is some kind of spring system.

We tested this adjustment with a high-accuracy gauge, and found it to be accurate to within about 5 per cent over most of its range, which we regard adequate for normal operation. Our check at the half-gram setting showed that accuracy had fallen off at this point, with actual weight being only .325 grams, but this position is of only academic interest, since it is not likely that many will be using cartridges capable of tracking at this weight.

Anti-skating adjustment is provided, which we found to be completely effective, even when operating with a playing weight of half a gram, and when a smooth disc (without grooves) was substituted. A separate control allows the anti-skating compensation to be adjusted to match the playing weight being used.

The driving motor is a hysteresis synchro-

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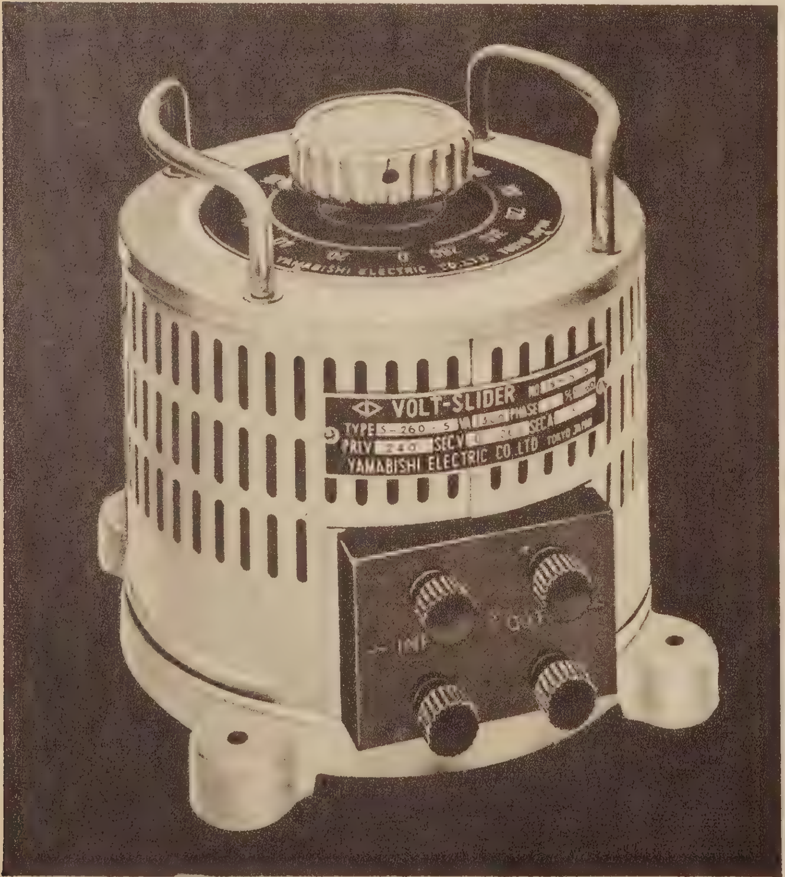

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nous type which locks to the 50Hz mains frequency and therefore ensures accuracy in turntable speed under widely fluctuating mains voltage conditions. With the addition of a heavy (5lb) turntable, indications are that wow and flutter will be at a low level. This was confirmed in listening tests.

A very useful feature, which indicates the careful thought which has gone into the design of this unit, is a stylus tip setting gauge mounted on the base-board under the cartridge shell. This enables the stylus tip of any cartridge used in the head to be accurately set to the correct position to ensure minimum tangential tracking error.

A screw adjustment at the front of the head shell is used to position the cartridge.

The base of the unit measures approximately 14in x 12in, and the makers specify a minimum size of mounting board of 17¾in x 14-3/16in. However, a point worth remembering is that the lever control used to operate the lowering mechanism is rather inconveniently situated close to the right edge of the baseboard, and close to the tone arm, so that it is necessary to leave sufficient clearance for comfortable operation of this device when mounting the unit.

A very comprehensive instruction manual is provided—and a word of caution here. Purchasers should read this RIGHT THROUGH before attempting to use the turntable. We found that the motor is locked in position for transportation by two plastic wedges which MUST be removed before switching on. However, this fact is not mentioned until page 7 in the manual.

In consideration of all the facilities provided and the generally high standard of manufacture, one is not surprised to find that the price of the Miracord 50H is fairly high, retail price being $148. This price includes a dynamic cartridge, but for those purchasers who wish to use a cartridge of their own choosing, the unit can be supplied without cartridge for $137. In view of the small reduction involved, one might conclude that the cartridge supplied cannot be regarded seriously, but we found it to perform well in listening tests, producing bright treble and good bass, with no obvious peaks. (H.A.T.)

GLASS ENCAPSULATED TIN OXIDE RESISTORS

CORNING GLASS WORKS is now stocking glass tin oxide resistors manufactured by an English associate company, Electrosil Ltd. The resistors are Electrosil's TR style, approved to triple rated pattern RFG5 of the U.K. Ministry of Defence specification DEF 5115-1, also used in Australia for military and professional electronics equipment.

The triple rating concept used in the TR style resistors allows the specification of the one style of resistor to be applied to varied applications in general purpose, semi-precision and many precision areas, according to how the resistor is rated. This results in significant purchasing and inventory economies.

Brief characteristics of the types being stocked by Corning are:

TR4: Semi-precision rating 1/10 watt with stability of 0.5 per cent; high precision rating 1/8 watt with stability 1 per cent; general purpose rating of ¼ watt with stability of 2 per cent; 51 to 47 K-ohms; 0.281 x 0.098in maximum; Pattern RFG5-F.

TR5: 1/8, ¼ and ½ watt ratings with stabilities of 0.5, 1 and 2 per cent; 20 to 470K-ohms; 0.375 x 0.15in maximum; Pattern RFG5-W.

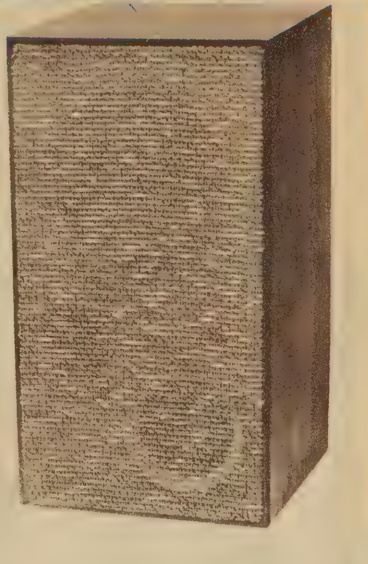
TR6: ¼, ½ and 1 watt ratings with stabilities the same; 20 ohms to 1 megohm; 0.539 x 0.19in maximum; Pattern RFG5-D.

A TR8 resistor is also available, with triple rating of ½, 1 and 2 watts. Its complete ohmic range is 100 ohms to 1.4 megohms. Stabilities are the same and case size is 0.728 x 0.19in.

Additional information is available from Corning Glass Works, 1202 Plaza Building, Australia Square, Sydney.

INSTROL "MINI" LOUDSPEAKER

During the month, Messrs Broadway Electronics (Sales) Pty. Ltd. submitted for review a pair of small loudspeaker units intended for use in space-saving, though good quality, stereo systems.



Largely the result of developmental work by the Mullard and Magnavox organisations, the units measure 14¼ x 8-1/8 x 8-1/8 inches, a size which allows them to fit readily into existing bookshelf structures.

Offered here under the name of Instrol "Mini" speakers, they are available in teak, walnut or maple, or other finishes to special order. Those submitted were in oiled teak and were simply but well finished on front and all four sides, appropriate to any likely listening-room situation.

Internally, the units are fitted with a Magnavox 6WR main speaker, with the Magnavox 3T tweeter, fed from the voice coil line through a series capacitor.

The enclosure uses the vented principle with a small, internal tubular port, the aim being to make maximum use of the back wave from the loudspeaker to reinforce output toward the low frequency end. The approach is in line with what we take to have been the original intention, namely to make the system as compatible as possible with low power amplifiers, having neither provision nor capacity for electrical bass boost.

In this respect, the concept differs from our own "Bookshelf" system, where we started out with less restrictive requirements in terms of size and an assumption that the units would be used primarily with amplifiers having a power output of 7 watts or more and bass-boost facilities.

Nevertheless, comparison with our Bookshelf system is more or less inevitable, both by way of interest, and as a guide to prospective purchasers. Our reactions could be summarised as follows:

SIZE, SHAPE: The Mini loudspeaker system is smaller, more "chunky" and more appropriate to actual use on existing shelves. Our Bookshelf, despite its name, finds as much application standing unobtrusively on the floor against curtains, or hung on walls. Its taller, slimmer shape is appropriate to these situations. As might be expected, the smaller internal volume of the Mini speaker imposes more severe design restrictions.

PRICE: The Mini system would normally be somewhat cheaper for the same standard of finish, because the materials cost is slightly lower and it does not include a cross-over network.

PERFORMANCE: At the bass end, output from the Mini system is sustained noticeably in the 90 to 120Hz region by radiation from the port. However, below about 90Hz harmonic output becomes progressively more evident, firstly with the emergence of second harmonic and then third harmonic. The effect can be seen on a mic./CRO set-up or heard on listening tests with sine-wave input. Though it could introduce problems higher up, blocking the port cleans up the waveform noticeably at these very low frequencies, indicating that the high velocity through the restricted port is responsible for much of the difficulty. The tendency for the Mini system to multiply low frequency energy up into the 100Hz region makes it rather inappropriate for electrical bass boost.

Against this, the Bookshelf system gives the immediate impression of having less prominent bass, and this is actually so, because the rear wave from the cone is dissipated isothermally in the internal filling. However, the roll-off is smoother and there is much less tendency to frequency doubling; modest bass boost can be thus used to good effect.

How important these factors are depends a good deal on listener perception and the kind of program most commonly reproduced. The difference is most noticeable in classical pipe organ music, where fundamental tones which are quite inaudible as such in the Mini are strong in the Bookshelf.

Over the middle and upper range, we compared the Mini system with one of our original Bookshelf units, using a 5-inch tweeter and a 2.5KHz crossover. This is still the system we prefer, because it shares the work load more equitably and minimises intermodulation effects.

In both cases, the frequency response was well sustained up to the limit of audibility, but the Mini system exhibited a more prominent middle register probably as the result of three minor factors: (1) No IR drop through the inductor winding; (2) larger overlap between the two speakers, operating from a common low impedance source; and (3) residual output from the port.

The difference, which was merely noticeable on sine wave tests, became most apparent with white noise input, the Mini system having a somewhat louder, and much more "middly" sound than the Bookshelf.

Based on these tests and on a variety of program material our verdict would be along these lines:

If you have a good amplifier system, with bass boost facilities, and can accommodate the larger bookshelf unit, it is the one to go for. Fundamental bass is better, the sound is "whiter" and the intermodulation lower.
it gives results far better than avail-
system, the Mini unit is worthy of consideration, particularly if space is limited. It makes good use of the signal drive available and one thing is certain—it gives results far better than available from routine loudspeakers hung in the usual open-backed radiogram cabinet.

In short, it does well the job for which it was developed. (W.N.W.)

AWA
BROADCAST AMPLIFIER
BAR-2
INPUT 1
INPUT 2
INPUT 3
INPUT 4
MASTER

TRANSISTORISED 4-CHANNEL REMOTE BROADCAST AMPLIFIER BAR-2

Specifically designed for outside broadcast use, the AWA BAR-2 Amplifier offers you these important features:-

- Completely transistorised
- Battery or 240V A.C. operation
- Low-noise input transistors
- Extra reliability with printed circuits
- Output transistors protected against line shorts

APPLICATION

The BAR-2 has four independent channels with balanced inputs and separate gain controls. Small and light in weight, it is 4½ in. high by 17¾ in. wide by 8 in. deep and only weighs 16 lb.

Housed in an aluminium alloy case the amplifier is finished in metallic grey and has an anodised front panel with black characters.

All controls, switches, VU meter and 'phone jack are mounted on the front panel. Batteries are held in place by special clamps in a compartment covered by a removable base plate.

Its weather-proof canvas carrying case is so designed that it is not necessary to remove it when using the amplifier.

AWA also manufactures a complete range of broadcasting equipment including transmitters on the medium or high-band operating frequencies.

For further particulars please contact Engineering Products Division.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITE
P.O. BOX 2516, SYDNEY, N.S.W. 2 023

TRADE RELEASES IN BRIEF

LESSEY PACIFIC PTY. LTD. has ounced the appointment of Mr W. ller-Gill to the new position of Manage- t Development Executive. He will be onsible for the development of future dle and senior-level management per- nel in Plessey's Australian companies.

n addition, he will help organise recruit- t, training and development programs gned to provide Plessey with sufficient nbers of qualified engineers and tech- ans to meet the company's expanding vities in Australia.

NTERNATIONAL RESISTANCE CO. Y. LTD. has been granted Quality roval Certificates by the Australian ned Services Approvals Committee to er the I.R.C. "M" coated high stability stors in the sizes DMA, DMB, DMC, IF and DMH.

R.C. has also been granted Qualification rovals for its Type 4V3J, 7V4J and '58 wire wound fixed resistors.

he company points out that these mili- specifications came into existence to re that devices being purchased for use the various government departments ld be of the highest quality and that h similar item would conform to the re- red acceptance standards. The specifi- ions also cover the detailed inspection sampling procedures to be followed, the detailed method of examination to used for inspections.

NITED RADIO DISTRIBUTORS PTY. D., who have traded from premises in llip Street, Sydney, for 20 years, have ved to new premises at Shop 32, Ash eet, Angel Arcade, Sydney. Customers advised that the new showroom can be roached either through Angel Arcade m Pitt Street, or through Paling Place m George Street, opposite Wynyard tion. Manager of the new premises is Donald Stuart.

OLA COMPANY (AUSTRALIA) PTY. D. is now able to supply 21 loudspeakers m its preferred range and seven from its -preferred range with 8-ohm voice coils. er types not yet listed as standard can supplied or request. A complete list of types available with 8-ohm voice coils obtainable from the Rola head office at e Boulevard, Richmond, E.1, Victoria.

ERGUSON TRANSFORMERS (SALES) Y. LTD. have advised that, because of reased costs of labour and materials, it been found necessary to increase selling ces of all products manufactured by guson Transformers Pty. Ltd.

wing to the variation in ratio of labour material used in components, the com- y has not found it possible to apply same percentage increase to its full ge of products, but the increases vary m a minimum of 10 per cent up to a ximum of 12½ per cent on previous prices.

PHILIPS ELECTRICAL PTY. LTD. e entered the gas chromatography field h a new range of equipment designed manufactured in Britain by the M.E.L. uipment Company. The equipment was oduced at the recent International Sym- ium on Gas Chromatography in Rome, ere more than 20 major units were ex- ited.

A distinguishing feature of the range is t all units — injection systems, oven perature controllers, column, detectors read-out units — are of modular de- n. Complete chromatographs can there- e be supplied which will exactly meet ividual requirements. Furthermore, such truments can be economically extended handle additional types of work as oc- ion demands. Solid state circuitry is em- yed, and high-quality components and strict engineering standards are claimed to result in high overall reliability.

In addition to the new range of "routine" chromatograph units, a prototype research chromatograph and a development model of an "automated" preparative chromatograph were demonstrated in Rome.

FOXALL INSTRUMENTS PTY. LTD., High Street, Armadale, S.E.3. Victoria are Australian agents for The Foxboro Company, U.S.A., which has just introduced a completely redesigned version of its Consotrol line of small-case electronic instrumentation. The new line is all solid-state, and the makers claim that it incorporates the latest advances in process control technology and is especially suited for centralised plant-wide control systems.

This new solid-state Consotrol instrumentation, comprising controllers, recorders,

(Continued on Page 148)

LETRASET TRANSFERS FOR CIRCUIT DIAGRAMS

Letraset Australia Pty. Ltd., 230a Sussex Street, Sydney, have sent details of their range of electronic symbol sheets for use in preparing circuit diagrams and printed circuit masters, letter and numeral sheets for chassis and panel marking, and their new Letraset tapes which are supplied in a convenient plastic dispenser.

The circuit symbols are supplied in sheets measuring 7in x 5in. Most sheets contain a variety of symbols of the same basic type, and the number of symbols to each sheet varies according to size, ranging from about 50 to more than 200.

The Letraset symbols are dry transfers which adhere firmly to any smooth, dry surface with which they are placed in contact, after the application of light pressure. Each sheet is supplied with a waxed paper backing-sheet to prevent the symbols from coming into contact with any surface to which they might adhere accidentally.

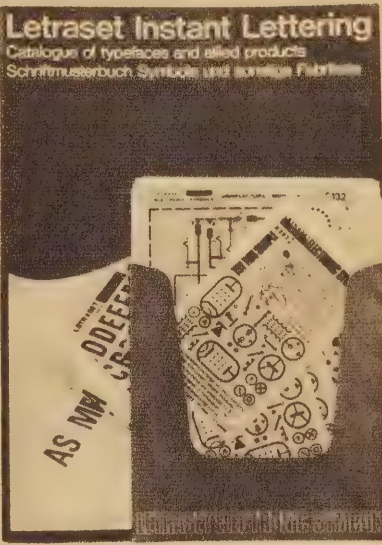
The range of symbols available includes those most commonly used, for example: Capacitors; resistors; rectifier diodes (full wave); rectifier diodes (half wave); inductors and transformers (two sheets); relay contacts; relay coils; branch jacks and keys; keys and break jacks; earth-to-ground; earth-to-frame; pluge and sockets; lamps, motors and instruments; transistors; rectifying valves; pentodes; double pentodes; cold cathode tubes; switches; wafer switches; multi-point switches; fuses, links and batteries; mechanical contacts.

The retail price per sheet is 48c, plus S.T.

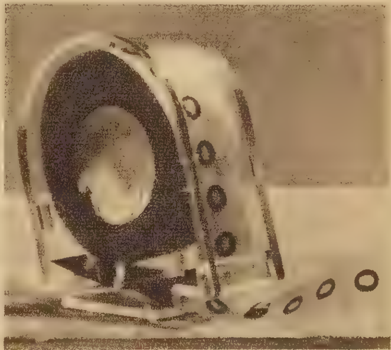
Realising that some purchasers might have only occasional need for these symbols, and would therefore be unlikely to use up the full-size sheets, Letraset has prepared an "Electronics Kit" consisting of 24 sheets measuring 3½in x 5½in. This sells at the attractive price of $4.50, plus sales-tax, and obviously represents very good value when compared with the cost of single sheets.

All symbols conform to BS 530 and, where relevant, have been drawn to meet Services preferences.

A handy storage cabinet which will hold 360 sheets is given free with an order of 120 or more sheets. This measures 8 x 4½ x 6in, made of heavy duty strawboard, and contains 24 stiff card wallets for filing sheets.


Letraset Instant Lettering
Catalogue of typefaces and allied products

Letraset sheets in a filing wallet and the Letraset catalogue. This catalogue and one of the sample sheets seen at the front of the filing wallet are available free.



A Letraset tape in its special plastic dispenser.

Letraset tapes are rather more convenient to use than the sheets, but each tape contains only one symbol, and these are mainly intended for use in situations where repetitive marking is required. Tapes can be supplied with any marking required, (customer supplies artwork) in widths from ¼in to 2in. The initial cost of the tape in the special plastic dispenser is $1.74 plus sales-tax, but refills tapes cost $1.50 plus sales-tax.

The containers have matching lugs and sockets on the opposing sides so that they can be assembled in rows to make a neat fitting on the work bench or draughtman's table. As the tape is withdrawn from the dispenser, the backing strip is automatically separated from the symbols. Since each width of tape contains only a single symbol, there is no risk of accidental application of adjoining symbols, as there is with the sheets.

The manufacturer's literature points out that the symbols are fungicidal resistant and can be used on equipment manufactured for tropical conditions. They are also heat resistant and dyeline copies may be taken without damaging the sympols. Additional protection when symbols are used on chassis and panels can be provided by a coating of clear varnish.

In addition to the examples mentioned above, Letraset sheets are available in a wide range of type faces and specialists' designs. A catalogue, sample sheet and other literature can be obtained from the Australian agents at the address given above.

DEITRON ELECTRONICS

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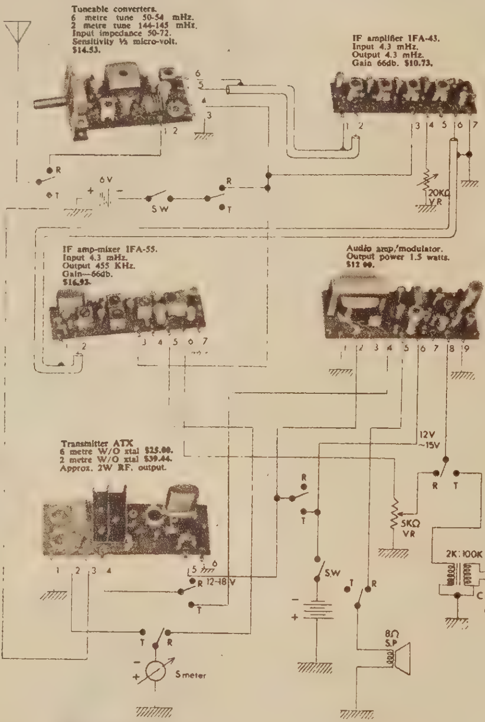
Tuneable converters.
6 metre tune 50-54 mHz.
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Input impedance 50-72.
Sensitivity ½ micro-volt.
$14.53.
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Approx. 2W RF. output.
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Features:
- Silicon transistors.
- Small in physical size.
- Low power consumption.
- Easily connect.

Prices are net including sales tax.

Xtal locked converters available.
6 metre—$16.91. With xtal.
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200mA.
0-20 volts
$19.40
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½, ¼, 1/8 or 1/32 watt preferred 10 per cent range. tol 5 per cent.

.001mf to .2 mf
5mf to 1000mf

MINI-LAB 7 in 1 MULTIMETER

$18.75

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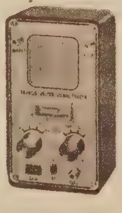

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Refer back issues for more information on above.

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Freq. Response
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$9.50.

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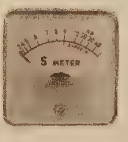

All popular volt, milli-amp. Amp, VU and S
1000 types ex stock.
MR—38P 1 5/8 x 1 5/8.
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COMING SOON ALL FERRITES, PVC-GANGS, POTS, ETC.

Suitable for Japanese Radios, etc.

---

indicators and auxiliary stations, is fu compatible with digital computers, th allowing the combination of computers a process instrumentation for integrated co trol systems. Further details are availal from the Australian agents, at the addr given above.

EMERSON AND CUMING, INC., Canton, Massachusetts, U.S.A., can n supply shielded chambers in kit form whi allows the customer to do his own co struction. Known as Eccoshield KCP Cha ber Kits, they consist of all the eleme required for installing the room on a su porting structure erected by the consum Kits are available for 11 different sizes chamber, ranging from 8 x 8 x 8ft to 8 16 x 24ft.

The makers say the chambers exhibit t following minimum insertion losses: mag tic fields, 40dB at 15KHz and 60dB 100KHz to 1MHz; electric fields, 100 from 15KHz to 100MHz; plane waves, 80 from 100MHz to 1GHz.

Australian agents for Emerson and Cu ing are Wm. J. McLellan and Co. P Ltd., The Crescent, Kingsgrove, N.S.W.

INTERNATIONAL RESISTANCE C PTY. LTD., has introduced another sty to its range of metal fin resistors. Kno as Type CCA (Style RN60) the resistor rated at ½ watt at 70 degrees C and available in temperature coefficient T (±100ppm/degreeC) and resistance valu from 100 ohms to 100K.

I.R.C. also advises that the Type CC metal fin resistor is now available in fo temperature coefficients, TO —T2 — and T6, with resistance ranges between ohms and 1 megohm.

Both types have been performance test to MIL-R-10509 D and E and have be found to be in excess of those requiremen They are fully insulated and protected tough moisture-proof "M" coat.

DUCON DIVISION of the Plessey Co ponents Group can now supply a range miniature carbon resistors manufactured Teikoku Tshushin Kogyo Co., of Japan.

Ducon says these resistors are eminen suitable for low power applications whe high levels of stability and close toleran are required, coupled with long life, sm size and economy.

The resistive element is of the pyroly cracked-carbon type deposited on an alka free ceramic substrate. The external coati is a high grade epoxy specially selected inhibit moisture, thus the resistors are idea ly suited to applications where stability ov long periods is important.

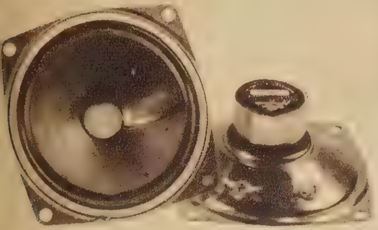
These resistors are available in two style Type RD-SZ are of the axial lead typ Type RD-TSZ are single ended types, su able for printed wiring board use.

Lead-tin alloy coated soft copper lea are used, which ensure excellent solderab ity by either manual or dip soldering tec iques.

Further details and a leaflet showi characteristics of these resistors is availab on request from the Ducon head office Christina Road, Villawood, N.S.W. (Box P.O., Villawood).

(Continued Opposite Page)

MAGNAVOX TWEETER



A new 3in curvilinear tweeter, Type 3TC has been developed by Magnavox (Australia) Pty. Ltd. Although an inexpensive unit, selling for $3.85 retail, it is an excellent performer.

A performance curve supplied by the akers show that the unit has a frequency esponse that is substantially flat (plus or inus 3dB) over the frequency range 6KHz o 20KHz, assuming a 2uF series capacitor nd a nominal 15-ohm circuit.

We tested the unit in our "Playmaster ookshelf" loudspeaker system and found to perform well, comparing favourably ith the 5in unit originally specified.

It should be noted, however, that, along ith the 5in tweeter, the original Bookshelf esign specified a 4uF series capacitor, as art of a 2.5KHz crossover network. The TC tweeter is not recommended for use ith a 2.5KHz crossover, because of natual limitations on the response and power andling imposed by the small cone. For se in the Bookshelf system, the 3TC should e operated in conjunction with a 5KHz rossover network, as described in the ecember 1964 issue.

Readers making up their own cabinets or the Bookshelf system should note that they intend to use this new 3in tweeter place of the 5in unit, they should reduce he size of the cutout for the tweeter from ½in to 2½in. When cabinets are purchased kit form, a patching piece may be used o reduce the size of the cutout, but this ust be airtight. One of the PVC type esin glues should make a good seal if the atching piece is screwed firmly into place ith screws placed at regular intervals round the diameter.

rade In Brief — cont.

INTERNATIONAL RESISTANCE OLDINGS LTD., have concluded discusions with Murata Manufacturing Company td., of Kyoto, Japan, on arrangements nder which companies within the I.R.H. roup will represent this highly regarded apanese component maker for a wide range f their speciality ceramic products.

The Murata company recently won world ecognition through their fundamental reearch into the properties of ceramic interediates, such as barium titanate. (Ceramic ntermediates may be broadly described as alf ceramic, half semi-conductor.) This has esulted in new and unique products which ill now be available to Australian design ngineers, says I.R.H.

The agreement covers the following products: ceramic filters, positive TC thermisors (known as "Positors"), piezo-electric uning forks and piezo-electric ignition elenents.

International Resistance Co. (Australasia), he Crescent, Kingsgrove, N.S.W., will andle inquiries initially. Technical data and amples will be available shortly, and I.R.C. ngineers are studying the application of hese products so as to be able to provide esign assistance when required.

"OXFORD"

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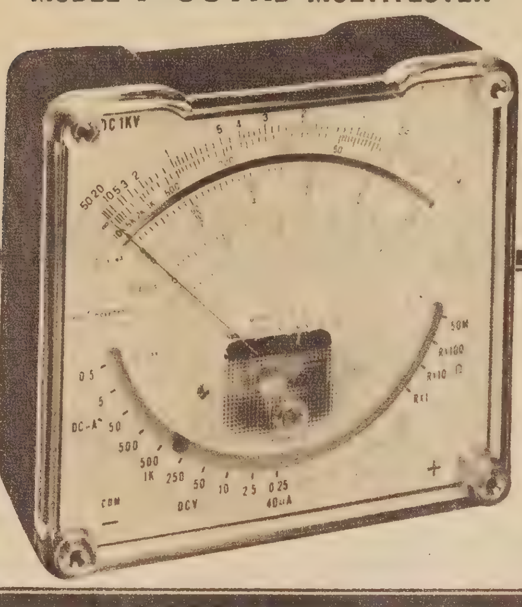
MODEL F-80TRd MULTITESTER



Check these features for versatility:

- The meter movement is of shock-proof construction capable of wit standing impact and vibration. High accuracy measurement is ensur for the frictionless 34.5 microampere movement. The range of the r sistance goes up to 50 megohms, powered by the internal batteries.
- Ranges are smoothly advanced forward and backward by a unique designed rotary-ring switch.
- The meter movement is protected from accidental impression of hi current.
- The LV and LI scales provided check all types of semiconductors.
- The germanium diode rectifier extends frequency response of the lo AC voltage range up to 100k cycles. Even the AC 250 volt range chec voltage of 20k cycles.
- The special scale provided reads the electromotive force of the batteri mounted in the meter.
- Clear-cut mirrored scale dial and long pointer afford accurate readin
- Overall appearance of the meter is elegant. The glossy, jet-black ph nol-resin rear case makes a beautiful contrast to the light, meta-acryl front cover.

Measurement Range Available:

DC voltage:	0.25v 2.5v 10v 50v 250v 500v 1000v (25k Ω v)
AC voltage:	2.5v 10v 50v 250v 500v 1000v (5k Ω v)
DC current:	0.04ma 0.5ma 5ma 50ma 500ma
Resistance:	Range — RX1 RX10 RX100 50MΩ
	Midscale — 100Ω 1kΩ 10kΩ 250kΩ
	Minimum 2Ω 20Ω 200Ω 5kΩ
Load current (LI):	15ma 1.5ma 0.15ma
Load voltage (LV):	1.5v 1.5v 1.5v
Volume level:	−10∼+10db +5∼+36db up to +62db
Tolerances:	±3% for DC voltage, current and resistance
	±4% for AC voltage 10v and up
	±6% AC voltage 2.5v alone
Batteries:	One each 1.5v and 9v dry cells
Size & weight:	108 × 116 × 49mm and 590gr

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12v. All Transistor P.A. AMPLIFIER

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ELECTRONIC FLASH

Part No.		
695	Printed circuit board	$2.50
124	Transformer 100 joule	$8.00
125	Trigger transformer	$2.00

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MULLARD 12 TRANSISTOR

5 watt x 5 watt.
Distortion ½ of 1%. Frequency response 30 cycles to 18Kc. Output 15 ohm speaker.
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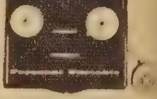

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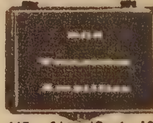

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AMATEUR BAND NEWS AND NOTES

nternational Regulations of Amateur Service

Careful consideration of some of the Radio Regulations adopted by the I.T.U. in relation to the amateur service coupled with the views expressed by an overseas visitor indicates that there is no room for apathy towards the possible reduction of amateur band frequency allocations.

By Pierce Healy, VK2APQ*

Mention is often made in these notes to e proceedings of the International Telemmunications Union, and the effect that ternational regulations formulated at T.U. conferences can have on the amateur rvice. To emphasise the effect of these gulations it is necessary to take a closer ok at some of them.

In the first instance, it must be underood that amateur radio is defined and gulated by international and national gulations. The Radio Regulations (R.R.) e drawn up by I.T.U. Administrative adio Conferences, which are attended representatives of Telecommunication dministrations of the Union's member untries.

The current Regulations were adopted by e 1959 Geneva Conference and were vised by the Extraordinary Administrative adio Conference held in Geneva in 1963 provide for allocation of frequencies for ace communication purposes. To agree to d sign the Radio Regulations at an I.T.U. nvention is to sign an international aty, so countries who sign must observe e regulations in regard to radio communition matters.

Radio Regulation No. 78 defines the amar service as: "A service of self-training, ercommunication and technical investitions carried on by amateurs, that is, by ly authorised persons interested in radio hnique solely with a personal aim and thout pecuniary interest."

The Radio Regulations also lay down frequency bands and stipulate the intertional conditions under which amateur tions are to operate. The use of freencies in each individual country and authority to operate an amateur stan are subject to national laws and reguions.

For the allocation of frequencies, the rld is sub-divided into three I.T.U. Rens. Region 1 comprises Europe, the ole of the U.S.S.R. and Africa. Region North, Central and South America, and gion 3, Asia (apart from Asiatic U.S.S.R.) d Australia.

The Radio Regulations provide for three egories of service, namely: primary, perted and secondary services as set out in 137-139 inclusive. For the use of freency bands in a portion of an I.T.U. gion or in a particular country, footnotes "additional services" and "alternative alations" have been added to the Table of equency allocations.

The notification to the Frequency Registration Board (an organ of the I.T.U.) of specific frequency assignments as required for most other services by Article 9 of the Radio Regulations does not apply to the amateur service.

Article 41 of the Radio Regulations contains most of the provisions specifically applying to the amateur service and these are mandatory. Radio communication between amateur stations of different countries shall be forbidden if the Telecommunication Administration of one of the countries has notified that it objects to such radio communication.

In this section of the regulations, the requirements in relation to the use of Morse Code (CW), are stated thus: —Any person operating the apparatus of an amateur station shall have proved that he is able to send correctly by hand and receive correctly by ear, texts in Morse Code signals.

Administrations concerned may, however, waive this requirement in the case of stations making use exclusively of frequencies above 144MHz.

All the general rules agreed to at an I.T.U. Convention and in the Radio Regulations apply to the Amateur Service, in particular the stability of the emitted frequency and the elimination of spurious emissions.

It is also stipulated that transmissions between amateur stations of different countries shall be made in plain language, limited to messages of a technical nature relating to tests and to remarks of a personal character. The use of amateur stations for transmitting international communications on behalf of third parties is forbidden; however, this may be modified by special arrangements between Telecommunication Administrations of the countries concerned.

All amateur stations are assigned call signs from the international series allocated to each country. The call signs have to be transmitted at frequent intervals during transmissions and at the beginning or end of each short transmission. The formation of call signs should be the combination of one or two letters followed by a single digit, followed by a group of not more than three letters.

Combinations that might lead to confusion, in particular with distress or signals of a similar nature, must not be used. Also the use of a combination commencing with a digit when the second character is the letter "O" or the letter "I" is not allowed.

The necessary technical qualifications and the maximum power to be used are fixed by the individual countries' Telecommunication Administration authority.

The definition of "Harmful Interference" is given in Radio Regulation No. 93, in

Frequency Allocations to the Amateur Service

Frequency Band	I.T.U. Region	Remarks
1.8MHz to 2.0MHz	2 and 3 1	Shared with other services. In certain Region 1 countries, 200KHz in the band 1.715MHz to 2.0MHz with power restriction 10 watts (RR194).
3.5MHz to 3.8MHz	Worldwide	Shared with fixed and mobile except aeronautical mobile, except: In Australia 3.5MHz to 3.7MHz exclusive allocation (RR206). In India 3.89MHz to 3.9MHz exclusive allocation (RR207).
3.8MHz to 4.0MHz	2	
3.8MHz to 3.9MHz	3	
7.0MHz to 7.1MHz	Worldwide	Exclusive allocation.
7.1MHz to 7.3MHz	2	Exclusive allocation. In South Africa and South-West Africa 7.1MHz to 7.15MHz exclusive allocation (RR212).
14.0MHz to 14.35MHz	Worldwide	Exclusive allocation except in U.S.S.R. band 14.25MHz to 14.35MHz shared with fixed service (RR218).
21.0MHz to 21.45MHz	Worldwide	Exclusive allocation.
28.0MHz to 29.7MHz	Worldwide	Exclusive allocation.
50.0MHz to 54.0MHz	Worldwide	Exclusive allocation except as stated in Radio Regulations 244-247, 238, 239.
144MHz to 146MHz	Worldwide	Exclusive allocation and specific authority for the use of artificial satellites by amateur service (RR284A).
146MHz to 148MHz	2 and 3	Exclusive allocation except in China, India and Japan, shared with fixed and mobile services (RR289).
420MHz to 450MHz	2 and 3	Secondary Service.
430MHz to 440MHz	1	Primary Service.
1215MHz to 1300MHz	Worldwide	Secondary Service.
2300MHz to 2450MHz	Worldwide	Secondary Service.
3300MHz to 3500MHz	2 and 3	Secondary Service.
5650MHz to 5850MHz	Worldwide	Secondary Service.
5850MHz to 5925MHz	2	Secondary Service.
10,000MHz to 10,500MHz	Worldwide	Secondary Service.

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30,000 Ohms per Volt D.C.

13,000 Ohms per Volt A.C.

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Printed circuit.

Clear Scale, rugged moulded case.

SPECIFICATIONS
DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.
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DC Current: 0-.06-6-60-600 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW. 600 ohms).
Audio Out: Capacitor in series with AC volt ranges.
Short Test: Internal buzzer.
Accessory: 1 pr. heavy test leads.

Price $31 (£15/10/

Postage 50c to $1 extra.

Batteries: 1 (1.5V), 1 (15V)
Size: 3 5-16" x 6 5-16" x 2
Weight: 1.4lb approx.

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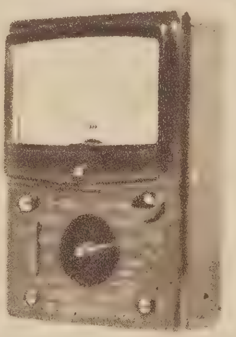
Model RH-10



RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.
AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.
DC Current: 0-500uA 0-500 mA.
Resistance: 0-10K-1Meg: 60 ohms, 6K ohms at centre scale.
Capacitance: 250uuF to 1uF, in two ranges.
Decibels:—20 to plus 36db, two ranges.
Output: 0-1,000 V in four ranges.
Size: 5in x 3½in x 1½in.
Weight: 13oz approx.

Price $10.75 (£5/7/6)

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Model RH-31

Model RH-31

- 20,000 Ohms per Volt on DC.
- 10,000 Ohms per Volt on AC.
- 3½" Meter.
- 18 position selector.

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AC Voltages: 0-5-25-100-500-1000 (10,000 Ohms/Volt).
DC Current: 0-50 uA, 0-5-50-500mA
Resistance: 0-6K-600K, 0-6Meg-60Meg (30) Ohms, 3K, 30K, 440K a centre scale.
Capacitance: 100uuF-0.01uF, 0.002uF 0.3uF.
Inductance: 20 H to 2000 H.
Decibels: minus 20db to plus 30d in 2 ranges.
Output Jack: for Audio measurements.
Dimensions: (3¾" x 5¾" x 2 3-8")
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Complete with internal battery an testing leads with prods.

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MODEL TP-5 POCKET VOM. TESTER

RANGES:

- DC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
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- DC Current: 0-500uA, 25uA, 500mA.
- Resistance: 0-20K, 0-2Mg. OHMS.
- Capacitance: 500uuF to 0.1uF at 100V AC. 0.01uF to 2uF at 5V AC.
- Decibels: minus 20 DB to plus 48DB in 5 ranges.

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Enquiries phone 61-3832 or write to 306 PITT STREET, SYDNEY e following terms: "Any emission, radia- ɔn or induction which endangers the func- ɔning of a radio navigation service or her safety service or seriously degrades, ıstructs or repeatedly interrupts a radio mmunication service operating in accord- ce with these Regulations."

The Radio Regulations provide that where ses of harmful interference occur, the ıtter must in the first instance be dealt th by the operating organisation and the lecommunication Administrations. Only ıen these negotiations have failed to pro- ce satisfactory results can recourse be ade to the I.T.U.

Administrations are to resolve these cases interference according to bilateral or ıltilateral agreements and by exercising e utmost goodwill and assistance.

Individual radio amateurs can assist their tional societies, Telecommunication Ad- instrations and international organisations, ırticularly the International Amateur Radio nion by reporting full details on inter- rence experienced when operating their ıtions according to international regula- ɔns and the laws of their country.

An "Experimental Station" is defined in ıdio Regulation No. 83 as: "A station ilising radio waves in experiments with e view to the development of science or chnique. This definition does not include nateur stations. Amateur stations are ɔsely related to experimental stations but e not fixed stations which provide a tele- ɔmmunication service."

It was Radio Regulation 284A, the first vised frequency allocation formerly adop- d by unanimous agreement at the 1963 ɔace Conference, that provided for the use artificial satellites by the amateur ser- ce and made the frequency allocation 144- IHz to 146MHz an exclusive band for the nateur service.

OUR OVERSEAS VISITOR

In mid-September a very well known over- as amateur, in the person of Wayne Green, '2NSD (Editor and publisher of the Ameri- n amateur radio magazine, "73"), passed rough Sydney.

Escorted by four members of the New ɔuth Wales Division, W.I.A., VHF and V Group, Wayne called on several Sydney nateurs.

Being included in the round of visits, I ok the opportunity to discuss with Wayne veral aspects of international amateur dio.

Among the subjects discussed were: The T.U., Amateur Radio in the less developed ɔuntries, the International Amateur Radio nion, Novice Licensing, increasing use of ɔmmercially built amateur-band equipment. The discussion was tape recorded and the llowing is a transcript of Wayne's words relation to the International Telecommu- ication Union.

The question asked was: "Is the power the I.T.U. over frequency allocations ɔpreciated by amateur associations you ıve contacted during your trip?"

Here is what Wayne said in reply:

"Well, of course, you have several aspects your question which are implicit and ay confuse.

"First of all, the I.T.U. has very little ɔwer, the I.T.U. is an organisation, and a ıry small one at that, which mainly gets e countries together to come to agree- ents, and they hope the countries will ɔide by the agreements, but it is entirely ɔluntary. There is police action, no sanc- ɔns whatever if a country does not abide y the agreements.

"But when the word 'power' is used I am orried that there might be a misunder- anding as to what the power of the T.U. is.

"The only power is the strength of the greements of the countries that have gotten gether and agreed. Now, of course, with e United States, Australia, Britain and few other countries, this is a very binding greement with them, and they stick by the greements made at I.T.U. very rigidly.

"Many other countries, a great many of em, use the I.T.U. agreements as a kind of advisory thing, and if it does not suit their purpose they do what they please and they are not really bound by the agreements of I.T.U."

VK2APQ: "Each country does have its own internal regulations which they are quite free to use as they wish."

Wayne: "Right, and the result of this is we do find a great deal of interference in our amateur bands where none is supposed to exist, and, of course, the commercial bands have the same problem. There is, relatively speaking, anarchy on all shortwave frequencies.

"Now, of course, since we are bound by the agreements of the I.T.U., this puts us at a rather great disadvantage with regard to those other countries who don't feel quite so bound, and it makes amateur radio particularly at a disadvantage because amateur radio in most of these countries has to stick by the I.T.U. regulations pretty carefully.

"We find a few countries where the amateurs operate outside the amateur bands and nobody is going to do anything about it, but if they want to talk to other amateurs they have to stay within the allocated bands.

"I think you were leading up to the possibility or probability of what is going to happen when the I.T.U. convenes next time, and the topic of discussion is the re-allocation of frequencies, amateur and otherwise.

"They are going to be discussing all short-wave frequencies and, of course, many of us are quite alarmed by the prospects of this conference that is coming up in about three years. We are particularly alarmed as we see the general trend of events in the I.T.U.

"The I.T.U. used to be largely run by, or controlled by, the European countries. The emergence of the African countries and their alignment with the Asian countries has changed the whole balance of power in the I.T.U. just as it has in the United Nations.

"We find the balance of power now lies with these new African and Asian countries and this is a bit upsetting for us because we realise that in virtually none of these countries has amateur radio any kind of force. Amateur radio is either unknown or just barely known in these countries and we suspect that we are not going to get a good deal of support toward the continuance of our amateur frequency allocations from these countries.

"One of the things I wanted to discover, and one of the main purposes of my trip, was to visit a number of these countries and find out just where amateur radio does stand. To find out how many people were licensed, how active they are, how many are European and how many are local, what the possibilities are for the licensing of more locals, what the general government feeling is toward amateur radio and what, if anything, can be done about it.

"I visited six African countries and 11 Asian countries and I think I have a fair picture of what the position is.

"In Africa I visited: Kenya, Tanganyika, Uganda, Ethiopia, Sudan and Egypt. In Asia I visited: Lebanon, Syria, Iraq, Afganistan, India, Nepal, Burma, Thailand, Malaysia, Singapore.

"I found in the bulk of these countries that governments were virtually unaware of the existence of amateur radio and that in a few of them they knew it existed but were quite suspicious of it. I did not find in any of these countries any degree of support for amateur radio. So as things stand right now I think that the prospects for amateur radio at Geneva in 1969 are rather dim.

"We can accept that or try to do something about it. I think it will be possible to affect a change which may result in the saving of our bands if we get busy.

"Number one: we want to make these countries aware that amateur radio has a tremendous value to them.

"I think we can get this story across to them so that they will appreciate that amateur radio is of tremendous importance to the development of their country and that their country cannot develop without amateur radio.

"This is true. Amateur radio is absolutely basic to the development of any country. No country has progressed into the modern world without a good foundation of radio amateurs, because it cannot be done.

"A country must have communications and electronics if it is going to develop in the modern world. Business, government and everything to do with the country depends on communication. It is absolutely basic, and you cannot have communication and electronics unless you have the people to do the job. You have to have them in quantity and the only source of these technically trained people, and technically interested people, is amateur radio.

"The only other way to get people into this is for the government to set up a training school and teach them, but this is almost prohibitively expensive.

"Amateur radio costs them nothing and they get trained people automatically. Roughly 50 per cent of the amateurs will go into communications and electronics. It has historically been that percentage in every country.

"Also amateur radio has the great advantage that it grabs hold of people in their High School years and sends them in the direction of communications and electronics. It gets them interested."

On that note the discussion continued on youth training schemes and novice licences. A transcript of this and possibly other subjects will be published in a future issue of these notes.

INTERNATIONAL CONVENTION

An International Radio Amateur meeting was held at Konstanz, Germany, on the 25th and 26th June, 1966. Hans Ruckert, VK2AOU, a Sydney amateur and member of the N.S.W. Division, W.I.A. attended the meeting. Hans gives this very enlightening account of his visit to Europe.

"About 10 years ago a group of oldtimers from DL, HB, OE and F, etc., proposed a meeting for amateurs with their families, additional to the conferences which mainly deal with administration, policies and technical matters.

"The place chosen was Konstanz, on the shores of beautiful Lake Konstanz, at the

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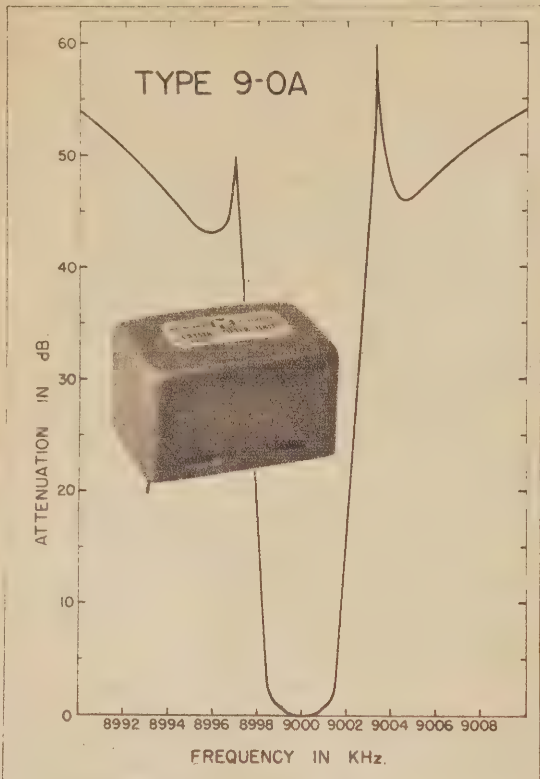

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This filter, supplied with two Style 'D' carrier frequency crystals and sockets, comprises a package unit. With each unit a typical schematic circuit diagram is supplied.

Specifications:

60 dB Bandwidth:	3 kHz. min.
40 dB Bandwidth:	6 kHz. max
Pass Band Ripple:	2dB max.
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Output Termination:	150 Ω plus 120 pF.
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Price each package unit — $30.00 plus tax.

Quantity discounts will be negotiated.

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$21.75 ***COMPLETE!*** ***POST FREE***
Anywhere in Australia and its territories.

For further details see Page 43, March, 1966, issue "Electronics Australia."

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As described in "ELECTRONICS AUSTRALIA", Feb., 1966

Especially for AMATEUR TAPE RECORDISTS, MOVIE MAKER and PUBLIC ADDRESS MEN. This mixing unit has been designe to blend together signals from up to four sources — two dynami microphones and two crystal-ceramic pickups. Fully transistorised, offers outstanding performance, compactness and economy of operation.

SPECIFICATIONS:

● Four-channel audio mixing unit using silicon transistors. ● Tw dynamic microphone channels; for high impedance types, input imped ance 50K with gain of 250. For low and medium impedance, inpu impedance 11K with gain of 750. Response 30cps to 40KC withi 3dB. ● Two crystal/ceramic P.U. channels; input impedance 500K unity gain. Response 20cps to 40KC within 3dB. ● Designed fo nominal 250mV output level, but will deliver more than 5V RM before clipping. Output impedance less than 22K. ● Mic. channel noise −54dB below 250mV output; pickup channels better tha −60dB. T.H. distortion at 1V RMS output 0.15 per cent. ● Maximum control interaction 1dB. ● Operates from two small 9V batteries drain 1.5mA at 18V.

Additional components for optional level metering and mains power supply circuits can be supplied for those who wish to build a more elaborate mixing unit. Ask for a quote.

$25

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iss and German border, with the 8000ft h snow-capped mountains of the Alps the background.

'The congress hall was the Council buil-g, which dates back to 1388, and is where Roman Church held a council meeting 1414 to 1418 to elect a new Pope.

'It so happened that our trip to Germany ng service leave and accumulated annual ve) made it possible to attend the Kons-z meeting, in the hope of meeting again . friends and more recent DX friends.

'Accommodation had been organised g before, because during that weekend hotels are occupied by amateurs from ny countries, and up to 2,500 had pre-usly come to this meeting.

'The council building stands right at the e harbour. From the restaurant on the :ace and the gardens one has a fine w across the lake.

'After checking in at the See-View Hotel Friday, June 24, I went to the council l. Hams were busy setting up the many nds for the amateur gear exhibition and : of equipment, which occupied the und floor.

'The car park was reserved for mobiles, convention station and the official VW-ses of the German, Swiss and Austrian ateur licensing officials.

'It did not take long for some old friends come along and shake hands and to ebrate the occasion. We had no trouble ognising each other, although we all had ome 1½ sun spot cycles older since : meeting.

'On Saturday, the amateur exhibition ened and the hall was as crowded as a l at the Royal Easter Show in Sydney. There was absolutely everything a ham ld wish for, or could be interested in. ur call sign in fluorescent plastic, com-te amateur TV transmitters, the full com-ment of about eight U.S. makes of eivers and transmitters, etc., beams, m parts, mobile aerials and mounts, eral makes of equipment made in Ger-ny, Japan, France, etc. (G-land missed).

'One could walk in with pockets full of ney and out with a complete radio lab. l ham shack. The prices are much lower re because the German free trade policy s not put high import duties on the ds.

In the afternoon, the reception for resentatives of foreign countries was held the 600-year-old town hall. About 18 ntries from all six continents were resented, and I had the honour to be only one from VK, also holding the . travel record.

Max Hull, W.I.A. Federal President, had t me a letter via our Federal Councillor 2APQ, asking me to pass the best wishes the VK hams on to those present at nstanz.

In the evening the ball was held in upper hall of the council building, ich was packed to capacity. It became cult to talk about CW, SSB, etc., in the sence of dance music QRM. It was there t I presented the President with a large merang, made in Northern Territory, as ravelling trophy for DJ/DL winners of VK-ZL Contest.

'DL7AA, a well known DX man from lin, won the trophy for his excellent 5 performance on CW and phone. It is ed that many more DL/DJs will now to contact us "down-under" during our test, having something special to fight

The licensing officials, in the e VW-busses, of the three countries, , HB, OE, spoke several languages. On senting a licence from any country passport, one was issued with a tem-ary transmitting licence for HB or OE also DL. They must be on good ns with their administrations.

Even on Sunday the brisk trading went in the exhibition hall. A number of 'Fox ts' with 2-metre and 80-metre gear inly mobile, but some on foot) were l. One could make a flight over the : and the Swiss Alps in a ham-piloted e. The tourist office invited visits to Switzerland, Austria and many other famous holiday centres.

"On my way around Germany, I visited DL1FK (editor of "DL-QTC," and DX partner of many VK's) in Hamburg, who showed me his town and the harbour. Coming from Sydney, one feels more at home in Hamburg than in any other European city (except for the hundreds of cranes in the harbour).

"Dick, DL1FK, is using a collection of Heath and National gear, and the visitor will find over his desk a reproduction of an Albert Namatjira painting. He supplies me with "DL-QTC," and I see that he obtains the A.R. magazine from VK."

VALE

During September the death of two New South Wales amateurs occurred. They were Ralph Miller, VK2ARM, a well-known VHF operator and Gordon McLeod, VK2ADC, who was a well-known DX operator.

The deepest sympathy of their friends in the amateur service is extended to their families in their sad bereavement.

QSL CARDS

The practice of exchanging QSL cards is almost as old as amateur radio itself and it may be interesting to readers to contemplate the views expressed by Henry Wilson, EI2W, past president, Irish Radio Transmitters Society.

The following extract was taken from an article written by EI2W, published in the International Amateur Radio Club magazine "Interadio."

"Some aspects of our hobby that are entrenched by tradition will have to be revised. I have always felt that too much time is spent by the average amateur in chasing awards and certificates. There are far too many of these in amateur radio.

"The QSL card is also becoming a millstone around the amateur's neck. I know there will be criticism of my views on this touchy subject, but one has to be honest and outspoken in this matter. The average small society today is finding the cost of maintaining a QSL Bureau a financial burden.

"A lot of money going into this traffic could be used to pay the expenses of delegates to international conferences where something constructive can be done for the amateur. The larger societies could study this problem carefully. Millions of cards are hoarded in amateur shacks to be eventually destroyed.

"A system of verification by national societies could be worked out and adopted whereby an amateur received one confirmation for each country worked. Surely this would satisfy the desire for proof of one's achievements? We must end this costly and time - consuming traffic which has far outlived its usefulness."

EI2W is located in the Dublin mountains, 1,000 feet above sea level and working exclusively in the UHF-VHF bands has contacted stations in Copenhagen (800 miles) on 2 metres and France (400 miles) on 70cM. The only contacts with California and Mexico from Europe during the International Geophysical Year, were from EI2W.

The QSL Bureau manager of the New South Wales Division W.I.A., Sid Molen, VK2SG, due to business commitments, has tendered his resignation effective from November. Sid, ably assisted by Ted Whiting, VK2ACD, has operated the N.S.W. bureau for the past five years and has handled tens of thousands of cards in spite of the claims of poor DX conditions. Thanks of the members of the Division are extended to both for their task well done.

Non-members of the W.IA. in New South Wales can obtain cards forwarded to the bureau by maintaining, at the bureau, a self addressed envelope and on payment of a small handling charge. Full details can be obtained by writing to the QSL Bureau Manager, Box 1734, G.P.O., Sydney.

In keeping with the practice of the majority of QSL bureaus throughout the world, cards received for non-members not claimed within a reasonable period are returned to the originating bureau.

ISRAEL

From time to time information comes to hand on the licensing conditions for amateur radio operators in overseas countries. The most recent to be received is the requirement for the Class "C" (Novice) licence in Israel. As there is no comparable type of licence in Australia the requirements laid down are of some interest.

At the present time there are about 300 licensed amateurs in Israel: those of the Grade "C" (Novice) comprise approximately 20 per cent of this number. To receive a Grade "C" licence, the candidate is required to pass the Examination for Radio Amateurs (Grade "C") conducted by the Director General of the Ministry of Posts. In this

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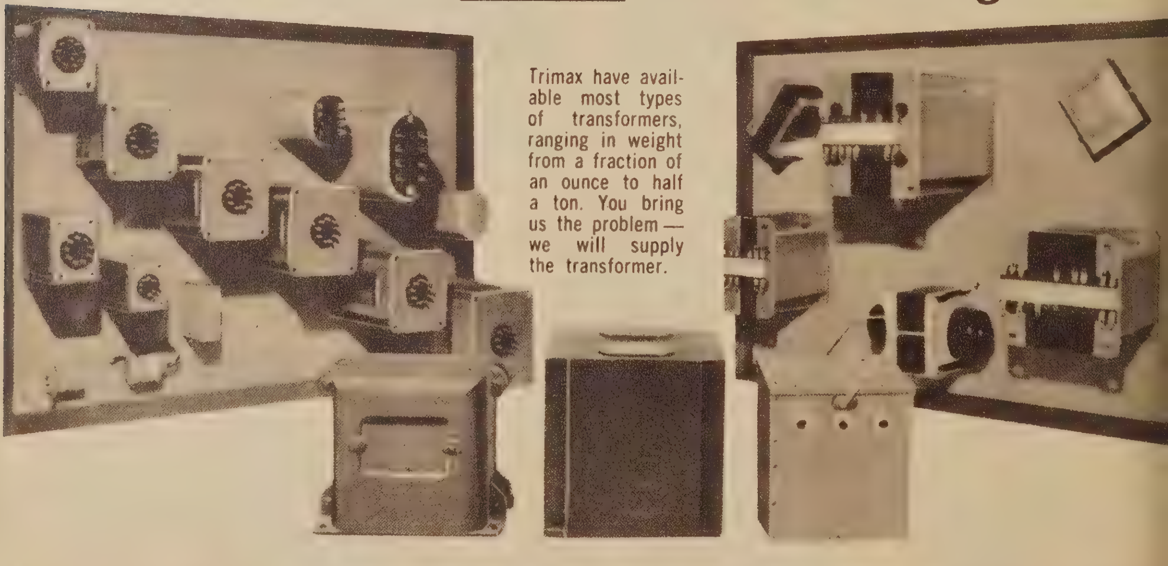

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I.A.R.U.

The problems associated with the formaion of a Region 111 body within the ramework of the International Amateur Radio Union is still receiving special attenion on the part of the Federal Executive and Divisional Councils of the Wireless Institute of Australia.

The New South Wales Division has aken steps to form a committee for the purpose of raising finance. Interest has been shown in the project by the New Zealand Association of Radio Transmitters and Hong Kong Radio Society in their eplies to inquiries made by the Federal Executive.

A summary of the members of the .A.R.U. and the licensed membership at he end of 1965 follows:

Initials	Country	Licensed Members
ARAEM	Morocco	70
ARI	Italy	1,800
ARRL	United States	78,891
ARSB	Barbados	38
ARSI	India	150
BARS	Bahamas	13
BARTS	Burma	25
ARRL	Canada	3,078
CRAG	Guatemala	130
CRAS	El Salvador	25
DARC	Germany	8,325
EDR	Denmark	1,800
GARS	Ghana	42
GRC	Ecuador	200
HARTS	Hong Kong	39
IARC	Israel	150
IRA	Iceland	18
IRTS	Ireland	132
JARA	Jamaica	28
JARL	Japan	13,200
KARL	Korea	61
LABRE	Brazil	4,000
LARA	Angola	148
LCRA	Colombia	750
LMRE	Mexico	890
LPRA	Panama	68
LRME	Mozambique	140
MARTS	Malaya	125
NRRL	Norway	928
NZART	New Zealand	1,775
OeVSV	Austria	579
PARA	Philippines	48
PZK	Poland	1,000
RAAG	Greece	24
RAL	Lebanon	25
RCA	Argentina	2,400
RCB	Bolivia	107
RCC	Chile	430
RCCR	Costa Rica	186
RCD	Dominican Rep.	145
RCP	Paraguay	326
RCP	Peru	520
RCU	Uruguay	1,200
RCV	Venezuela	1,250
REF	France	2,104
REP	Portugal	280
RL	Luxembourg	59
RSB	Bermuda	45
RSC	Ceylon	50
RSF	Russia	3,500
RSZ	Zambia	42
RSGB	United Kingdom	7,700
RSSR	S. Rhodesia	132
SARL	South Africa	1,700
SRAL	Finland	1,777
SRJ	Yugoslavia	3,600
SAA	Sweden	2,081
TIR	Syria	15
UBA	Belgium	560
UCAR	Congo	—
URE	Spain	975
USKA	Switzerland	600
VERON	Netherlands	1,122
VERONA	Netherland Ant.	12
WIA	Australia	2,454

These figures were taken from the 1965 edition of the International Amateur Radio Club publication "INTERADIO." Some other interesting facts extracted from the statistical data given is: 27 countries including Australia have a power limitation for the amateur service of 150W or less. n 21 countries the permitted power range s from 200 to 800W, while in 17 countries he limitation is 1,000W.

WIRELESS INSTITUTE ACTIVITIES

The Federal Contest Committee of the W.I.A. has advised that the John Moyle Memorial National Field Day will be held over the weekend of February 11th and 12th, 1967. Full details of the rules will be published in future issues of these notes.

Rules for the 1966-1967 Ross Hull Memorial UHF - VHF Contest will be published next month.

NEW SOUTH WALES

A lecture given by Norm Burton a very well-known short-wave listener, to the September general meeting of the division, brought back many pleasant memories to the older members and gave the younger ones a look into the past.

The lecture, entitled "Radio Communication—Past and Present," was illustrated by a large number of slides and covered the early experiments and equipment used by Marconi, and other early pioneers of radio communications.

Photographs of many historical documents were included. Ships installations from the days of the rotary spark gap transmitters and coherer receivers to the present day radio telephone and teleprinter equipment, clearly showed the amazing progress that had been made within the past 50 to 60 years.

WICEN NOTES

Further to the list of crystal frequencies required to put various makes of car-phones onto the WICEN VHF net frequencies, Peter Campbell, VK2AXJ, has given the following details.

Channel	Transmitter	Receiver
A	3038.63KHz	14795.4KHz
B	3041.66KHz	14810.0KHz
C	3043.75KHz	14820.0KHz

These are for the Courier F.M. 100. Modification details were given in the W.I.A. magazine "A.R.," August, 1964.

The crystal frequencies given refer to the VHF nets only. HF net frequencies in the 7.0MHz and 3.5MHz bands have not been set as most stations have VFO control and a suitable channel would be selected when the neccessity arose.

Severe congestion has occurred on Channell B net frequency. It is suggested that it would be a definite advantage if more stations would obtain crystals for channels A and C. Net operation on the three channels could then follow the pattern used in Victoria, i.e.

Channel A Mobile to Base.
Channel B Mobile to Mobile.
Channel C Base to Base.

It is also recommended that a pause of 3 seconds between transmissions be observed.

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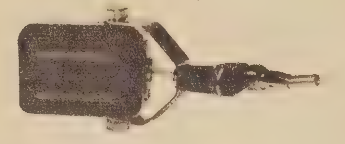

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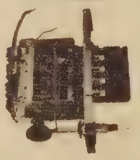

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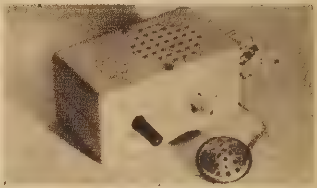

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6AN7	... 12/6	SP61	... 10/
6N8	... 12/6	UU9	.... 10/

CENTRAL COAST BRANCH

\t the September meeting of the Central ast Branch, Lionel Dooland, VK2ZLD, e an interesting lecture and demonstra- 1 on "Printed Circuits," which it was :ed, seemed to emphasise how apt the n "Wireless" is.

The Branch Christmas Party will be d on December 7th at the new Bistro staurant in William Court, Gosford. A icious Smorgasbord dinner is planned, be preceded by "punch," conversation, The accommodation is limited, so mbers and intending visitors are requested to make reservations early.

The Branch meetings are held on the d Friday of each month, in the School Arts, Mann Street, Gosford.

QUEENSLAND

Following the successful "Fam-Fest" held February, it has been decided to again d the get-together of Queensland and thern New South Wales amateurs and ir families at Kingscliffe, a few miles th of the N.S.W.-Queensland border.

The date set by the committee is Novem- 20th, when it is expected that states l be vying with each other to have the atest attendance.

Visitors and those holidaying at the rist spots that abound the nearby areas l be particularly welcomed.

WEST AUSTRALIA

n the September issue of the West Ausian VHF Group news bulletin, notice given of the intention to shift the MHz beacon from its present freency to one higher in the band, possibly .3MHz.

The change was made because 144MHz oo close to the frequency to be used in Australis satellite project.

t is also proposed to bring the frequency d in "Fox Hunts" to within 300KHz of beacon frequency so that those who car radios after a converter will be to tune both the "Fox" and beacon quencies.

he new president of the Group, D. ham. VK6HK, has submitted a program activities for the coming year. Judging the scope of the proposals it is going to a very active year on VHF in VK6.

NEW TRANSCEIVER TESTED

When a VHF operator appears on SSB the DX bands that is news and when unit being used is the latest model of SBE-34, that's news also.

'K2APQ has for 48 hours, prior to npleting these notes, been evaluating the SBE-34 SSB transceiver on the 7MHz, 14MHz and 21MHz bands.

The unit is complete with AC and DC power supplies. The entire transceiver package is less than one-half cubic foot in volume and weighs approximately 18 pounds. It contains 23 transistors and only three valves and for mobile work has a current drain of 0.6 amps on standby, 3.6 amps with transmitter filaments and high tension on. On transmit (single tone) the current drain is 14 amps.

A 2.1KHz Collins mechanical filter is used. A pitch control is provided for tuning the receiver 500Hz either side of the transmitted frequency. Small plug in VOX and crystal calibrator units are optional accessories.

From interstate reports received and the DX heard using dipole antennas, indications are that it is a well above average piece of equipment.

Hawker De Havilland Australia Pty. Ltd., Raytheon agents for Australia, are considering the possibility of marketing the unit.

IELD DAY IN BLUE MOUNTAINS

The Annual Field Day of the Blue lountains Branch of the Wireless Initute of Australia will be held at the sual venue — The Lawson Swimming ool grounds. The date set down is unday, November 20, when the eather in the mountains should be very easant.

A full program has been arranged hich will commence with a 144MHz ramble at 10.30 a.m. and conclude at l p.m. Operation can be carried on the ay to the Field Day if desired.

Registrations will commence at 10.30 m.

At 11.30 a.m. a 144MHz "Sniffer unt" within the ground.

1 p.m. to 1.45 p.m. a 144MHz hidden ansmitter hunt.

Leaving at 1.30 p.m. there will be a us Trip for the ladies to some of the enic spots in the mountains.

Later in the afternoon there will be a reasure Hunt and a 7MHz Scramble.

ne final portion of the program will be e presentation of prizes at 4.15 p.m.

There will be the usual ice-cream, inks and hot water available plus some sposals equipment.

All visitors will be welcome — keep unday, November 20 clear for that trip the mountains.

YOUTH RADIO SCHEME

A report from the examiner for the Elementary Certificate in New South Wales, Doug Williamson, gave details of the successful candidates at recent examinations. The report gave the total as 21, and praised the high standard of work of the club leaders and of the papers submitted by candidates.

The clubs from which the successful candidates came were:—

Canterbury District Scouts: Three Honours passes from a total of three candidates. The club instructor is Stan Bourke, VK2EL.

Ryde High School; Brian Fowler, the instructor, had the club's first successful candidate.

Griffith High School; Geoffrey Leaver, son of a well-known YL operator VK2SU, gained an Honours pass.

Marist Brothers Radio Club, Pagewood. Two Honours and three Credit passes. Brother Romuald is the instructor.

Marist Brothers Radio Club, Maitland, where Brother Cyril is the instructor, one Honours and two Credit passes.

Special mention was made of the candidates instructed by Roger Davis, VK1RD, himself an ex-YRS Club student.

Roger instructed three groups: the first group, Postal Group No. 3, had two excellent passes with Eric Gauja gaining a 99 per cent pass and P. Frazer a 93 per cent pass; the second group, the Canberra Radio Society, had three Honours and one Pass; the third group, at Lyneham High School, had two Honours, one of which was a 98 per cent gained by Alan Klason.

Of the 21 candidates, Eric Gauja and Alan Klason will receive book prizes donated by The Overseas Telecommunications Commission (Australia). All other successful candidates will receive a transistor donated by AWV, and packets of resistors and capacitors donated by Standard Telephones and Cables Pty Ltd.

To meet local conditions, it has been decided the Youth Radio Scheme of the Victorian Division, W.I.A. will become a self-supporting group which is not relying on but affiliated with the W.I.A.

This decision means that a small fee will have to be paid by a club or an individual to become a registered member of the Club Scheme in Victoria. It was agreed by the organisers and club leaders that this would not present any major problem and it has been left to the committee to assess the operating costs and decide what the fee will be.

The Committee elected for the forthcoming year are:—

Supervisor: H. W. Rider, 232 Cumberland Road, Pascoe Vale.
Secretary-Treasurer: M. Plummer, 66 Roland Road, Strathmore.
Examinations Officer: D. Buck, 263 Gooch Street, Thornbury.
Registration Officer: W. J. Allen, 82 Morley Street, Glenroy.
Transmission Officer: D. F. Reid, 355 O'Heas Road, Pascoe Vale.

Details of the scheme can be obtained by writing to the supervisor or personal contact with any member of the committee.

It has also been agreed that at least one meeting should be held each school term to allow club leaders to discuss teaching and other problems, also to allow an interchange of ideas.

Two new clubs have been registered:

Burwood High School Radio Club; Club Leader, J. Payne, 5 Warren Street, Burwood.
Bayswater Youth Training Centre; Club Leader, W. Tremewen, 34 Flower Street, Fern Tree Gully.

Tape Recorder Enthusiasts Check Your Head Alignment & Frequency Response

TEST TAPES

NOW AVAILABLE

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No. 1. Pure tones 40-10,000 C/S with voice Identification of each band at 7½ I.P.S. Track 2 continuous 7,500 C/S tone.
No. 2. Pure tones 40-7500 C/S with voice identification at 3¾ I.P.S.
No. 3. White noise one third octave bands 40-10,000 C/S track to full range unfiltered white noise at 7½ I.P.S.
No. 4. White noise one octave bands 100-6400 C/S track two full range unfiltered white noise at 7½ I.P.S.
No. 5. Azimuth and vertical head alignment tape can be used without test equipment at all tape speeds and 2 or 4 track heads.

EACH TAPE IDENTIFIED ON 3" REEL IN CARTON
PRICE $7.20 EACH.

Also available: 40ft length of tape with white noise and 2-1" length of rubber magnetic strip on card with full instructions. Price $1.20.

FULL DETAILS SENT ON RECEIPT OF STAMPED AND ADDRESSED ENVELOPE AVAILABLE FROM

J. H. McGrath Pty. Ltd.,
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TRANCEIVERS

COMMUNICATOR 1 WATT

15 Transistor Squelch. Bat Meter Earphone. Leather Case. 12 mths. warranty.

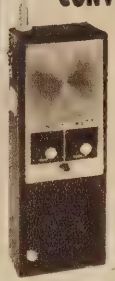
Price $90 each

TELECON 1 WATT

13 Transistor Squelch. Bat Meter. Phone. Jack Mike Jack. 6 mths. wty.

Price $121.00 each

CONVOY 1 WATT



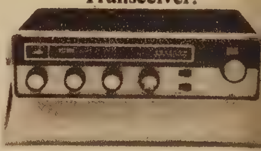
13 Transistor Squelch. Bat Meter. Phone. Jack. Leather, on Steel case.

12 mths. wty.

Price $116 each

TELECON 5 WATT

Special Purpose Transceiver.



Suit Ham, use 26-28MC 12-volt or b./1 Ac. Conv. 6XTAL Channels, plus Tuneable receiver.

Price $202. each

TR105 - 100MW

6 Transistor Super Het. All Metal. Very Clear.

$30.00 each.

2 Rechargeable Bats. Plus 1 Charger **$8.00** extra.

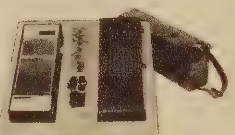
TOKAI - TC911

100 MW 9 Transistor Metal Case. Sep. Mike, earpiece, Leather case.

Price $59.50 each

STR 64/A 100MW

9 Transistors. All Metal. Leather Case.



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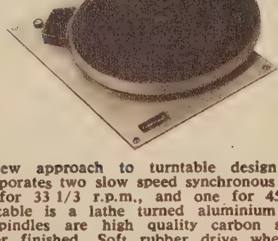
Connoisseur

TURNTABLES AND PICK-UPS NOW DISTRIBUTED BY ENCEL ELECTRONICS!

The complete range of the renowned "Connoisseur" turntables is now on display at all Encel Stereo Centres . . . and the famous "Connoisseur" pick-up and cartridge. Generally Encel Electronics prices will parallel or be less than U.K. equivalents . . . this price structure follows Encel policy of making fine equipment available to more music lovers. All models are fully guaranteed and complete stocks of spares are carried by Encel Service Divisions in Melbourne and Sydney. Mail orders? Of course . . . we will care-pack and freight anywhere. Write or call for complete specifications.

CONNOISSEUR "CLASSIC" TURNTABLE



A new approach to turntable design . . . incorporates two slow speed synchronous motors, one for 33 1/3 r.p.m., and one for 45 r.p.m. Turntable is a lathe turned aluminium casting — spindles are high quality carbon steel — mirror finished. Soft rubber drive wheels disengage when not in use.

ENCEL PRICE: $33.50 (£16-15-0)

CONNOISSEUR "CRAFTSMAN" 2-SPEED TRANSCRIPTION TURNTABLE

Very popular overseas, the Craftsman features two fixed speeds and a full 12in lathe turned non-ferrous turntable. This precision instrument employs a hysteresis synchronous motor which is dynamically balanced . . . wow is 0.15 p.c., flutter 0.1 p.c., and rumble —50db at RIAA characteristics when referred to 7cm/sec., at 1000 c/s.

ENCEL PRICE: $49 (£24-10-0)

CONNOISSEUR "CRAFTSMAN III" 3-SPEED TURNTABLE

Here is perfection in a precision 3-speed tran cription turntable . . . and at a price to ensu a ready market. Fitted with a 12in non-ferrou lathe turned turntable and a hysteres synchonous motor, plus or minus 4 p.c. spee variation may be made quickly and precisel Built in illuminated stroboscope.

ENCEL PRICE: $67.50 (£33-15-0)

CONNOISSEUR SAU-1 PICK-UP ARM

Fitted with an automatic lifting and lowering device, this fine transcription tone arm features a single pivot point for both vertical and lateral movement and the shell accepts standard ½in mounting cartridges. Height and stylus pressure are fully adjustable.

ENCEL PRICE: $18.50 (£9-5-0)

CONNOISSEUR SCU-1 STEREO CARTRIDGE

When tracked at 2-4 grams the SCU-1 provides very pleasing stereo listening . . . with excellent separation and perspective. Tip mass is 1 milligram and diamond stylus diameter .0005/.0006in. Easily the best stereo cartridge at this price.

ENCEL PRICE: $10.80 (£5-8-0)

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ELECTRONICS PTY. LTD.

HEAD OFFICE: 431 Bridge Rd., Richmond, Victoria. Tel.: 42-3762.

CITY STORE: 18 Bourke St., Melbourne. Tel. 32-2672.

N.S.W.: 257 Clarence St., Sydney. (Ground Floor, 2SM.) Tel.: 29-4563, 29-4564.

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

ew DX Session from South Africa

Radio South Africa recently announced the commencement of a weekly DX Session from its studios in Johannesburgh, while plans to commence a service for listeners in North America will be put into effect this month.

he lastest schedule of Radio South
ca lists transmissions for Europe, Africa
the United Kingdom, while test trans-
ions to North America are expected to
n this month when a third 250KW trans-
er is added. The new program "DX
ner" is included in "South African
orama," every Thursday. The present
dule is:

GMT	9525, 7270KHz
	21495, 17805, 15220, 11900.
	11900, 9525.
	11900, 9690.

new full colour verification card has
issued and is sent to listeners who send
rts to Radio South Africa, P.O. Box
Johannesburg.

e test transmissions, which will use the
250KW transmitters as well as some
e older 20KW transmitters, have been
duled to be on the air November-
mber on a test basis as follows:

-0025GMT	Canada 11900KHz
-0025	Canada 9525
-0125	U.S.A. 11900, 9525
-0325	U.S.A. 11900, 9525

e North American aerial array at the
mendal transmitting station, located 40
from Johannesburg, has not yet been
pleted, and for these test transmissions
available aerials will be slewed as far
as possible.

LATIN AMERICAN NEWS

roundup of recent reception reports of
-American stations shows that several
ons have frequently been heard in the
ic area and in Europe. Radio Nuevo
do, Santiago, Chile, using 11740KHz
been noted at 1200GMT. Signals from
V on 6095KHz, which we reported
tly, have also been noted in Europe
his frequency, thus confirming our re-
of a frequency change by this Colom-
station. A Guatemalan station closing
340 on 6205KHz has the call sign
P and uses 500W. XERR in Mexico
is good at 2200 and causes some in-
ence to Radio New Zealand at
GMT when both use 15110KHz.

n on in English from any Latin Ameri-
is not a frequent occurence, but the
ield (Nicaragua) station YNRG, on
KHz, is received at fair level with the
GMT sign-on announcement. Peru-
station OAX6U Radio Universidad in
uipa has been heard on 6245. The
n is scheduled for 6235KHz, but is
slightly higher than Budapest on
KHz. Signals are best at 0330GMT.

48 at La Paz (Bolivia), is being heard
30 and in reply to a recent report it
ed our reception with a pennant. Radio
ica which has been on the air for
al years has been noted now on OAX4V using 6010KHz at 0500 and announces that OBX4U on 3240KHz has the same program.

VOICE OF DENMARK

The new schedule of the Voice of Denmark, in Copenhagen, shows a reduction in one transmission and extensions in the transmission times of others. The transmissions to North Africa and the Middle East have been discontinued, and listeners in these areas are now catered for by services to South Africa and the Asian area. The program duration has been extended to one-and-a-quarter hours, the first 30 minutes being in Danish and the balance of 45 minutes in English.

The English transmissions are now on the air to North America 0145-0230 on 9520KHz, and 1245-1330 on 15165KHz. To Far East 0745-0830, to South Asia 1445-1530 and South Africa 1915-2030 all on 15165KHz. On Saturdays, a transmission at 1045-1100 on 9520KHz, is beamed to the Far East. Listeners in Australia and New Zealand should find the early transmission at 0745GMT will give more reliable reception than the old 0800-1000GMT service.

CAMBODIA ON 4925KHz

The reception of the Voice of Cambodia on the new 60M channel of 4925KHz has been noted at 1100GMT. The broadcasts are heard with popular music then at 1200GMT the station has a news bulletin in French, and at 1200 and 1230 station identification is given in English. Pat McRodden of Dunedin, N.Z., who first reported this new Phnom Penh channel, says that the signals are fair, but some side interference is noted from Brisbane, Queensland. The station is listed to use 5960KHz at this hour and it seems that a change to a lower channel has been made.

Another Asian signal, Radio Nepal at Katmandu, is being also received at improved level when using the 4600KHz channel. The station has English at 1500, and the station sign off is at 1525GMT.

GOSPEL RADIO RECEPTION

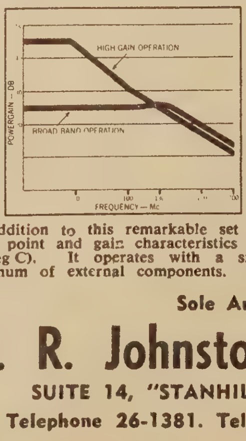
Costa Rican station NTIFC at San Jose, which is seldom reported, is now being heard on 9645KHz with sign on at 1200GMT. The station, using the slogan "Lighthouse of the Caribbean," is heard opening with the English identification with some sideband interference from Seoul (South Korea) on 9640KHz.

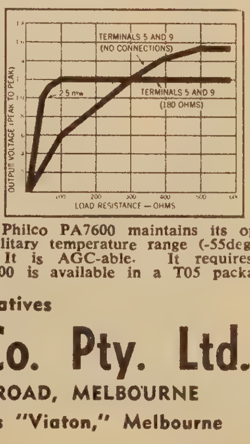
This station, is received by New Zealanders best in the period around 0400 in the winter months, and in the past a relay on 6037KHz has also been observed. Bolivian station CP39 at La Paz with the slogan "Southern Cross Radio" is heard at 1100GMT, but the frequency of 4985KHz suffers some interference from the Radio Malaysian station. which before this time is at fair level in its gospel program. The station has the call CP75 assigned to this frequency. Haiti site of a further gospel station at Cap Haitian is reported regularly on 6120KHz. Reception of 4VEH on the 120M channel of 2450KHz, opening at

PHILCO MICROELECTRONICS
ANNOUNCES THE PA7600 BROADBAND AMPLIFIER
45 db at 60Mc 25 db at 160 Mc 2.5 Mw power output

We are, frankly, excited about the potential of this new device — about the design possibilities it opens for you in such fields as broadband video amplifiers, RF and IF amplifiers through VHF, oscillators and the like.

An examination of the gain vs. frequency curves (Measured with 50 ohm source and load) also suggests the desirable bandpass flatness (plus or minus 1 db). And the Voltage vs. Load Resistance curve reveals a 2.5 mw power output—more than adequate to drive, say, a detector.





In addition to this remarkable set of parameters — the Philco PA7600 maintains its operating point and gain characteristics stable over the full military temperature range (-55deg to 125deg C). It operates with a single power supply. It is AGC-able. It requires a minimum of external components. And the Philco PA7600 is available in a T05 package.

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27.240 m/c $3.00
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or $5.50 per pair. Either type.

MULTIMETER MODEL 200H

20,000 ohms per V. d.c. 10,000 ohms per V. a.c.

Specifications:
DC volts: 0-5, 25, 50, 250, 500, 2,500.
AC volts: 0-10, 50, 100, 500, 1,000.
DC current: 0-50 uA.; 25, 250 mA.
Resistance: 0-60 K ohms: 0-6 meg.
Capacity: 0.01-0.3 uF. (at AC 5v); 0.0001 - 0.01 uF. (at AC 250v).
Decibel: Minus 20 db, plus 22 db.
Output range: 0-10, 50, 100, 500, 1,000.
Battery used: UM3 1.5s, 1-piece. Dimensions: 3¼ x 4½ x 1⅛in.

Complete with internal battery, testing-leads and prods.

Price $10.75 inc. tax

Post 25c

MULTIMETER

Model CT-630

30,000 ohm/volt DC
15,000 ohm/volt AC
DC Volts: 0.3, 0-15, 0-60, 0-300, 0-600, 0-1200.
AC Volts: 0-6, 0-30, 0-120, 0-600, 0-1200.
DC Amperes: 0-0.03, 0-3, 0-30, 0-300mA.
Ohms: 0-16K, 0-160K, 0-1.6M, 0-16M, (10, 100, 10K, 100K at centre scale)
Decibels: Minus 20 to plus 46dB.
Dimension: 90 x 132 x 36mm.
Net weight: 380g.

Price: £9/5/- ($18.50)

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6 in twin cone, rated 5 watt, 60-16 Kc, 8 or 16 ohm available **$5.00, £2/10/0**
8 inch twin cone, rated 10 watt, 60 to 16 Kc, 8 or 16 ohm available **$7.50, £3/15/0**
12 inch twin cone, rated 10 watt, Ferrite Magnet **$10.00, £5/0/0**
6 inch Coaxial, rated 8 watt, 60 to 16 Kc, 8 or 16 ohm available **$11.00, £5/10/0**
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(Mullard outlook, April, 1966, edition). Built by Approved Magnavox Manufacturer. Completely built and polished maple, walnut or teak.

With Speakers, each .. . **$27.00, £13/10/0**

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AC107	$1.90	BC108	.90
AC125/OC70	.90	BC109	$1.30
AC126/OC75	.90	BF115	.90
AC127	$1.00	OC26/AD149	$2.25
AC128	.95	OC30	$4.10
2-AC128	$1.25	OC35/AT1138A	$3.25
AD149/OC26	$2.25	OC44N	.90
AF114N/OC171	.95	OC45N	.90
AF115N	.95	OC70	$1.16
AF116N/OC170	.90	OC71/2N215	.75
AF117N/OC169	.90	OR 3 for	$2.00
AF118N	$2.00	OC71	$1.25
ASZ20/2N370	.90	OC72	$1.25
AT126/AC126	.90	OC74N/AC128	.95
AT310 Silicon	.95	OC75/AC126	.95
AT311 Silicon	.95	OC202	$3.00
AT312 Silicon	.98	2N217	.95
AT313 Silicon	$1.00	2N217/S	.95
AT314 Silicon	.90	2N370/ASZ20	.90
AT315 Silicon	.95	2N372	$1.75
AT316 Silicon	.95	2N410	.85
AT1138A/OC35	$3.25	26278 Delco	$3.00
BC107	$1.00	2N301 AWV	$2.30

Germanium, Silicon and Zener Diodes

BA100	.45	OAZ205	$1.50
BY100	$1.55	OAZ208	$1.25
OA5	.70	OAZ212	$1.25
OA79	.30	OAZ213	$1.25
OA90/OA80 1N34A	.30	OAZ222/BZZ14	$2.00
OA91/OA81	30	OAZ224/BZZ16	$2.00
OA200	.70	OAZ225	$2.00
OA202	.75	OAP-12 Light/sens 1N3194/OA210	.85
OA210/1N1763/ 1N3194 HR25, 400PIV, 400MA	.85	1N3193/OA605	.55
OA211/BY100/S1AR2 1000PIV 1 amp.	$1.60	1N3491 50PIV/18A	.95
AO605/1N3193	.55	1N3491R	.95
OA650	$1.10	1N3492 100PIV 18A	$1.20
OAZ200	$1.50	1N3492R	$1.20
OAZ202	$1.50	1N3493 200PIV 18A	$1.30
OAZ203	$1.50	1N3660 100PIV 25A	$1.55
		1N366OR	$1.55

ALSO MANY OTHERS TO ORDER.

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CV448/OA81 Germanium Diodes.
22c each or 12 for $2.00.
2SA29/OC44, 75c or 3 for $2.00.

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STP-66 12 inch Turntable, 3 speed Syncronous motor, complete with All Balance Arm and Magnetic Cartridge. Wow below 0.2%. Rumble below 40 db.
Price **$55.00, £27/10/0**
10 inch Turntable, as above **$50.00, £25/0/0**
Spare Magnetic Cartridge .. **$6.75, £3/7/6**
Polished Base for above turntables .. .. **$6.00, £3/0/0 Extra.**

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DF3. Dynamic Pencil Type 500HM or 50K available **9.00, 90/-**
B1051. Dynamic Thin Pencil Type, polished aluminium finish. Response, 15-15KC) 50K OHM only **$7.50, 75/-**
B1052. Dynamic Dual Impedance Pencil Type (600 ohm and 50K) (Response 15-15KC) **$11.50, £5/15/-**
B1053. Uni Directional Slim Pencil Type Dual Impedence (500-50K) (15-15K) **$18.00, £9/0/0**
B1401. Microphone Stand, Desk Type **$1.80, 18/-**

24 WATT STEREO AMPLIFIER

and Pre-amp (Similar Star SA30)

12 watts per channel, 8 and 16 ohm outputs, Rumble Filter, etc. Few only at this price **$80.00, £40/0/0**

RECORDING TAPE SPECIAL

(This Month Only.)

Scotch brand, 1800 ft on 7 inch reel lubricat Acetate **$3.50, 3**
Scotch brand, 300 ft on 3 inch reel polyest base **$1.20, 12**
Lafayette Brand, 1800 ft, on 7 inch reel po ester base **$3.95, 39**
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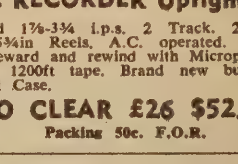
Lafayette Brand, 1200 ft on 5 inch reel po ester base **$3.25, 32**

POST 10c per Reel.



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NUOVO FARO NF-20

TAPE RECORDER Upright Typ

2 Speed 1⅞-3¾ i.p.s. 2 Track. 2 Moto Takes 5¾in Reels. A.C. operated. Compl fast foreward and rewind with Microphone a BA.S.F. 1200ft tape. Brand new but sligh damaged Case.

TO CLEAR £26 $52.00

Packing 50c. F.O.R.

WANTED TO BUY

COMMUNICATION RECEIVERS, TRAN MITTERS, TEST EQUIPMENT, AMPLIFIER TRANSISTOR RADIOS, TAPE RECORDER SPEAKERS, TRANSFORMERS, ETC.

STEREO AMPLIFIER

10 WATTS

Manufactured to give stereo amplification o a wide frequency range, the Stereo Ampli uses the new 6GW8 Audio Tubes to attain fine performance. It has stereo inputs outputs to suit most requirements. We also supply any auxiliary equipment that be required.

SPECIFICATIONS

MAX. OUTPUT POWER: 10 Watts, 5 Wa per channel.
FREQUENCY RESPONSE: 50 to 15,000 c.p plus minus 1 db.
HARMONIC DISTORTION: Less than 2 cent at normal levels.
CROSSTALK AT 1 KC: Better than 40
HUM AND NOISE: 40 db. below rated outp
INPUT (FOR FULL OUTPUT):
Phono CER.: 0.22V., 100,000 Ohm.
Phono x-tal: 0.24 V., 50,000 Ohm.
Aux.: 0.15V., 150,000 Ohm.
OUTPUT IMPEDANCE: 4, 8 and 16 Oh (Each channel).
SELECT SWITCH:
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3. Phono—Mono.
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VOLUME CONTROL: Channel 1 with Power Switch and Channel 2.
TONE CONTROL:
More than 14 db. at 10,000 c.p.s.
More than 11 db. at 100 c.p.s.
VACUUM TUBE: 2-6GW8, 1-6CA4.
POWER SUPPLY: 240V. 50 c/s, A.C.
OVERALL DIMENSIONS: 11in x 6½in 4½in.
NET WEIGHT: 10lb.

Price: £19/-
($38.00)
inc. tax
PACKING 50c F.O.

, has been noted by Barry Hewitson of oria. The power is only 250W on frequency.

VRH13 USING 3980KHz

new frequency for the Fiji Broad- ng Commission in Suva has recently put into service to carry the English ram during their evening transmission. I13 using 3980KHz is providing very l signals from as early as 0700, when a bulletin is heard, to sign off at 1030- T, with the same program on VRH8 on KHz. The new VRH13 is scheduled use 500 watts and has been heard ing at 1800GMT under the call VRH6 5955KHz, when also it relays VRH8. ne station advised some weeks ago, as l in these pages, that the new trans- er was to be VRH12 on 3935KHz to English, and VRH13 on 3980KHz d carry the vernacular program. How- some alterations have been made, as vernacular program on the second V transmitter has only been observed 800GMT when using VRH7 (6005-) and relaying VRH9 (3284KHz).

DX WORLD PROGRAMS

lditional programs of "Arthur Cushen's World" are now being broadcast,with session also now being carried on the B.C. domestic network. The session is broadcast as follows.

dio New Zealand. First Wednesday of month at 0640 and 1030GMT on and 9540KHz. Following Saturday at GMT on 15110 and 11780KHz.

Z.B.C. all-night transmission. Third day of each month, 2.15 am N.Z. (Friday 1415GMT) on 2YA 570, 640, 3YA 690, 1YA760 and 4YA 780-

NOTES from readers should be sent ARTHUR CUSHEN, 212 Earn eet, Invercargill, N.Z. All times listed Greenwich Mean Time, add eight rs for Perth, 10 hours for Sydney l 12 hours for Wellington time. Fre- encies are listed in Kilohertz.

SWISS CHANGES MADE

e Swiss Broadcasting Corporation at has made some frequency changes the summer months, including the llation of the transmission to the ic for early afternoon listening, be- the evening transmissions are expected more reliable during this period.

e 0115GMT transmission to the Paci- n 11775KHz has been cancelled, and transmission is now only for North ica. At 1330 to Asia, 11855KHz has ced 15305KHz. The transmission at to the Near and Middle East will be 900KHz, which replaces 11880, and to America at 0415GMT, 6120KHz is in place of 11715KHz.

LASHES FROM EVERYWHERE

ZILIAN station Radio Tupi in Sao ulo on 17820 or 17815KHz is widely orted from Europe on this new fre- ency. The station has been heard from 5-1055GMT after Berne leaves the fre- ency at the conclusion of its Portuguese gram, and before Radio Canada opens 1100GMT in its service to Europe. The eption of signals from Radio Tupi 17815KHz is noted to as late as 0230 n off.

I over Radio Teheran has added an litional frequency for its service to ope and is also now heard on 35KHz from 1540 with Home Pro- m, and to Europe 1730-2130 GMT. station also uses 11005 or 15140KHz imes, so it seems this 19M band chan- is not very stable.

SIA in Arabic has been reported at 0 on 6195KHz by John Heron of ney, and signals at this time are free

NEW SCHEDULES AND FREQUENCY CHANGES

SYRIAN BROADCASTS

The latest schedule of the Syrian Broadcasting Service shows that transmission from Damascus are as follows:

1600-1900	15165KHz	Europe (French-English)
0500-0700	7390	Omnidirectional
2330-0200	17865 15190	Spanish, Arabic
0400-2200	6165	Libya, Egypt (Arabic)

The station verifies reception reports by registered mail, with a verification card, some of our readers report.

RADIO GHANA

Transmissions from Radio Ghana at Accra have been extended and the recent program schedule shows the increased services which are now being provided for its international broadcasting.

Area	GMT	KHz
North America	0330-0430	6110
	2000-2100	11800
	2000-2100	9760
South America	0430-0515	9760
Central America	0600-0645	9760
Australasia	1500-1545	17910, 21545
Ethiopia, Far East	0300-0345	6130
Far East	0430-0515	9545
	1330-1430	17910
	1815-1900	15285
West Africa	0530-0730	3340
	1400-2215	6130
Europe	0645-0730	9545
	2045-2215	9545
East Africa	0300-0345	6070
	1330-1430	17910
	1500-1545	21720
	1600-1630	15285
	1815-1900	15285

RADIO NEW ZEALAND

The new schedule of Radio New Zealand in Wellington includes the use of a relatively new channel, 11830KHz, in the relay of the home program. The present schedule is:

Pacific Islands		
	1700-1945	ZL7, 6080KHz
	1700-1945	ZL2, 9540
	2000-0545	ZL19, 11830
	0600-0845	ZL2, 9540; ZL7, 6080
To Australia		
	2000-2230	ZL2, 9540
	2245-0545	ZL21, 15110
	0900-1145	ZL2, 9540; ZL7, 6080
To Antarctic (Sun)		
	0815-0845	ZL7, 6080.

RADIO CANADA SCHEDULE

The latest schedule of Radio Canada in Montreal, shows that the services now provided cover all parts of the world with the exception of Asia.

Transmission details from the Montreal station, with transmitters at Sackville (New Brunswick) with three 50KW transmitters are as follows:

Time	KHz.	Target Area
0725-0820	9625, 5955	To Africa and B.B.C. rebroadcast.
0825-0935	9625, 5970	Australia, New Zealand, South Pacific.
1056-1214	15320, 11720, 5970	Europe and North Canada.
1215-1313	15320, 11720, 5970	Europe, Caribbean, U.S.A.
1316-1344	17820, 15320, 11720	Europe, Antillies.
1345-1515	17820, 15320, 11720	Europe.
1516-1529	17820, 15320, 11720	Europe-N. Canada.
1530-1630	17820, 15320, 11720	Europe.
1631-1659	17820, 15320, 11720	Europe-N. Canada.
1700-1830	17820, 15320, 11720	Europe.
1832-1945	17820, 15320, 11720	Africa.
1945-1958	15320, 11720	Africa.
2000-2152	15320, 11720, 9630	Europe.
2158-2246	15190, 11720, 9625	North Canada.
2258-0046	11760, 9625, 5990	Caribbean, South America.
0058-0230	11720, 9625, 5970	N. Canada.
0230-0555	11720, 9625	N. Canada.
0555-0630	11720, 9625, 5955	N. Canada-Europe.
0630-0706	11720, 9625	N. Canada.

The expansion plans of Radio Canada have been announced and four or five 250KW transmitters will be put into service within two years; then in the following phase, more transmitters will be added. The antenna system will use single-frequency curtain types and will cover from 6 to 21MHz. The complete new transmitter complex will include seven 250KW transmitters at the Sackville site, as well as the three 50KW transmitters now in use.

RADIO NEDERLANDS CHANNELS

Some new frequencies are listed by Radio Nederlands in Hilversum (Holland) and the station proposes to put these channels into operation in the near future.

Metre Band	KHz
11M	26040, 25610
13	21715, 21665, 21625, 21570, 21565, 21480.
16	17840, 17830, 17815, 17810, 17800, 17775, 17765
19	15445, 15425, 15320, 15180, 15160
25	11970, 11960, 11955, 11950, 11935, 11930, 11800, 11780, 11750 11730, 11710
31	9750, 9745, 9730, 9715, 9630, 9590, 9525
41	7210, 7165, 7110
49	6085, 6035, 6025, 6020, 6005, 5985, 5980

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v operated, complete with speaker and amplifier.

£57-10-0 $115.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

12/6 $1.25 each.

Post 10 cents

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule,
1 Lampholder.

18/6 $1.85

Post: N.S.W., 30c: Interstate, 40c.

PMG TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

£11-10-0 $23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9 Lens, stops 11, 8, 5.6, 4, 2.9.
With 3in x 8in F1 Dallmeyer Lenses complete with wooden case.

£19-10-0 $39.00

50c Cartage to Rail. Freight payable at nearest attended railway station.

SHIPS' CLOCKS

(No bell). Smith's 8-day, fully jewelled. Original cost $120. Special 7in brass $25. 10½in Seth Thomas splash-proofed bakelite

£15 $30

Post N.S.W., 70c: Interstate, 95c.

ECHO SOUNDER

Depth and Fish Finder. Transistorised, with Neon Flasher Indicator, complete and Guaranteed.
12 V.D.C. operated (8 1.5 Torch cells).

£42-10-0 $85 Post $1.60

12 CREED TELEPRINTER

Tape printers model 47.R, 240 Volts operated.

£17-10 $35.00

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire, 1,320ft coil of twin (equal ¼ mile), $7.00 per coil.
Post, N.S.W. 70c: Interstate $1.20.

3000 TYPE RELAYS

P.M.G, 200 Ohm — 1,500 Ohm Coils, $1.25 each.

AWA OSCILLOSCOPE

Calibrated with delay time base. 5in, 240 vac., perfect.

£97-10-0 $195.00

AMPLIFIER

Subminiature 4-Transistor, Audio Push-Pull.

£3-10-0 $7.00 Post 50c

GOOSE NECK LAMP

NEW, IDEAL FOR DESK or WORK BENCH. Adjustable shade, strong metal lacquered base and frame. Height 18in. Complete with lead.

12/6 $1.25

Post and packing, $1.00.

DRAFTING MACHINE

Genuine Swiss-Wiles (Without Scale).

£9/15/- $19.50 Post $1.20

P.M.G. Phone Jack and plugs, 25c each, 45c the pair.
Post 7c.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

10/- $1.00 each

Post, N.S.W., 25c; Interstate, 35c.
1.2 volts 15 AH, 8in x 4in x 2in, $2.95.
2.4 volt 10 AH, 6in x 2½in x 2in. $2.50.
Post, N.S.W., 30; Interstate, 40c.

PERSPEX

Slightly domed shape, 16in x 12in, $1.55. 2ft 6in x 18in tapering to 6in, $1.75. 2ft 6in x 2ft, $2.45. Domed approximately 3ft 6in x 2ft, $5.50.
50c cartage to rail. Freight payable at nearest attended railway station.

P.M.G. TYPE KEY SWITCHES.
45c each. Post, 15c.

VALVES

BRAND NEW

IN CARTONS.

Special discount for quantity

6SN7GT	95c	6AG5	50c
89	$1.00	X61M	$2.20
12SA7	$1.25	CV850	$1.50
6H6	45c	18H6G	30c
41	$1.25	832	$5.00
5U4G	95c	6F13	75c
77	$1.00	6AK5	$1.50
VR150-30		6X4	$1.00
	$1.00	6F8	75c
5CPI	$3.95	6N7	$1.00
EF50	35c	12SK7	50c
6U7	75c	VR1120	50c
V1103	$1.00	VR118	75c
VH120	75c	VR65	25c
IL4	$1.00	6R7GT	50c
5Y3	$1.50	VT4C	75c
6C4	50c	AU5	$1.00
CV2184	$2.25	80	$1.25
2 x 2	75c	6AK5W	$1.50

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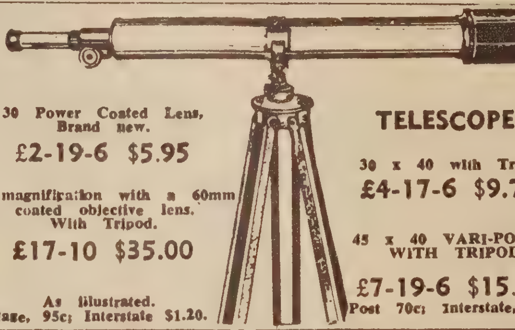

30 Power Coated Lens, Brand new.

£2-19-6 $5.95

60 magnification with a 60mm coated objective lens. With Tripod.

£17-10 $35.00

As illustrated.
Postage, 95c; Interstate $1.20.

TELESCOPES

30 x 40 with Tripod

£4-17-6 $9.75

45 x 40 VARI-POWER WITH TRIPOD

£7-19-6 $15.95

Post 70c; Interstate, 95c.

HIGH STABILITY RESISTORS

I.R.C. brand new ½w., 1w, 2w, tolerances between 1 and not exceeding 5% including 100, 360, 560, 750, 15K, 22K, 27K, 100K, 180K, 220K, 560K, 820K, ohms. Usual price 40c each, 50 assorted different values for only

37/6 $3.75

Post 15 cents

GENUINE VARIACS

0-115 V.A.C. 18 Amps, $29 each, or couple 2 together for 240 V.A.C,

The two for $45

Genuine American Zenith Variacs

0-115 V.A.C. 7.5 Amps, $19.50 each or couple two together for 240 V.A.C.

The two for $36.

50c cartage to rail. Freight payable at nearest attended railway station.

522 TRANSCEIVERS

100 to 150 m/cs.

£17-10-0 $35.00

TR1934 TRANSCEIVERS

100 to 125 m/cs.

£16-10-0 $33.00

FRACTIONAL 240V AC MOTOR

1/25 h.p., new, with coupled 2-speed gearbox. 1425 and 300 r.p.m. Ideal for rumbler, etc.

£10-0-0 $20.00

Post N.S.W., 70c; Interstate, 95c.

BATTERY CHARGER KIT

TOP grade, imported from England. Complete assemble yourself with instructions.

6 or 12 volts. 2½ amps without meter, $8.50 or £4/5/.
2½ amps with meter, $10.50 (£5/5/).
4 amps with meter, $12.50 (£6/5/).
Post. N.S.W., 70c; Interstate, 95c.

C.M.A. CABLE

240 volt 3/.036 black, new and perfect. 100 yds. rolls, $3.00. 6 or more.

£1-5-0 $2.50

30c cartage to rail. Freight payable at nearest attended railway station.

MICROMETERS

Brand new Goodell-Pratt, 0 to 1in, $7.50: Slocombe, 1in-2in, $7.85; Starrett 1in-2in, $9.85.
Post, 32c.

CHOKES, 7.5H, 60mA 95c
VIBRATORS, 6 volts, 7-pin, 75c each.
UNISELECTORS. 4 BANK HOMING TYPE $4.00
INVERTERS, 26v-115v 2Kw 400 cycle $9.50
HAND MICROPHONES, with Press-to-Talk Switch .. 95c ea.
Post, N.S.W., 25c; Interstate, 30c.
INSTRUMENT TRIPODS, sturdy wooden frame. Telescopic Extend to 4ft 6in $13.00
SELSYN MOTORS MAGSLIP Mk. II .. .. $5.25 ea.
No. 19 2-way radios, with hand set, power supply, leads. $35.00
Meggers, bridge type, complete and tested $75.00
EVERSHED and VIGNOLES, 500 volts.

ASTRONOMICAL TELESCOPES

3¼" Reflector. 126 Magnification complete with 4X Finder and Equatorial Mount.

£29-10-0 $59.00

Post N.S.W. 70c, Interstate $1.20

BINOCULARS

PRISMATIC. Coated Lenses.
Brand new. Complete with cas

8 x 30	$19.5
7 x 50	$26.5
10 x 50	$27.5
12 x 50	$28.5

Post, N.S.W. 70c; Interstate, $1.2

SPECIAL ARMY RELEASE.

TELESCOPES

ALL LENSES "ASTRONOMICAL" QUALITY

General and Marine Use

4 x 40 Genuine HANDLEY Cost $60.00. Our Price, $6.5
7 x 40 GENUINE OTWA ANGLE TELESCOPE. Cost $9 Our Price $9.8
15 x 40 variable Power Otwa $15.50.
Freight payable at nearest attended railway station.

PROJECTOR LAMPS

BRAND NEW PHILIPS
240 volts. 750 watts.
Base down.

£1-5-0 $2.50

Post 13 cents.

4 DIGIT RELAY COUNTER

50-volt D.C., suit slot car. La counters, etc.
$1.25. 12/6 each.
Post 13c.

RECORDING TAPES

SCOTCH BRAND.
EX-WOOMERA.
SLIGHTLY USED.
PERFECT ORDER.

Can be used for home video, tap recording equipment, etc.
2,400ft 12in Reel ½in Top Grad Cost $14.50. Our price $7.5 roll. Post 70c; Interstate, 95
Also same in ¼in. Ideal for pro fessional quality audio recordin
1200ft 7in reel ¼in $2.75. Post 12
600ft 5in reel ¼in $1.68. Post 12
200ft 3in reel ¼in 65c, Post 10

SCOOP PURCHASE

Gramo. Motors, New, Made i U.S.A. 4-speed. 240 volt A.C 50 cyc. Only $2.75 each.
Post, N.S.W., 30c; Interstate, 40

240-110 VOLT 6KV TRANSFORMERS

Encased, including switches, new, $50. £25.

KLYSTRON MIXER/DUPLE units, 12,000 megs, complete wi crystals, $13, £6/10/ eac
Post. N.S.W., 45c; Interstate, 50

LEAD ACID BATTERIES

New 2 volt 1.5 amp. $1.75, 12 vo 0.75 amp. $3.75.
Post, N.S.W., 25c; Interstate, 30

SPECIAL lucky dip valve offe 15 new valves in cartons f only $2.00. We haven't got tim to sort them, so you reap t benefit. Post, 30c.

SOLENOIDS

Plunger Type 12V 300M.A. Su electric camera control, miniatu trains, radio, etc.
$1.25. Post 10c.
200 Mill. amp., 24 volt, 1/8 push movement.
$1.25. Post, 10c.

BATTERY CHARGER

6 or 12-volt, 2½ amp, without meter, $10.50, £5/5/.
2½ amp with meter, $12.60, £6/5/.
4 amp with meter, $14.50, £7/5/.
Post. N.S.W., 70c; Interstate, 95

TELEPHONES

Sound Powered. Can be used Microphone and Receiver, Ne With 50ft cable.
$3.85 pair.
Post, 25c; Interstate, 40c.

Deitch Bros.

70 OXFORD STREET, SYDNEY

SORRY, NO C.O.D.

›m interference. Before this time, interference is common on the frequency from B.B.C. London.

GARIAN station Radio Sofia is using ee out-of-band channels and signals in peranto from 2005-2030 and Italian 30-2100 on 5920KHz. The frequency 6245KHz, is used for transmissions to rope 1930-2210GMT. Another frequency, 7670KHz, is also used for the vice to Europe. Best reception is at 00GMT.

HUANALAND is now reported to be sting with a 10KW transmitter, on 36KHz, 1300-1400GMT. This is the st step in a local short-wave service for s country, which is soon to become independent.

EL now broadcasts to South Africa om 2030-2045, but a recent report states s could be retimed to 2015-2030 when station uses 9009, 9725KHz. Transssions to Europe are: In French 2045-00, and in English 2100-2115; while the l Zion program is also on the air in glish on Sunday from 0900-1000, 9009 d 11900KHz.

NACO station Trans World Radio, ich we recently listed as moving from 60 to 7295KHz, is noted opening at 00GMT in English and announces they w have transmissions in 24 languages. e station has Hebrew on 11725KHz 1745GMT, and in Arabic at 1810 on same frequency. The station is rerted also at 1815 in Armenian when ng 11765KHz.

O in the transmissions of Radio Nory is on the air at present from 0300-30, 9550, 9610, 11850KHz; 0745-0815 11850, 15175, 17815, 21670; 1100-30, 7240, 15175, 17825, 21670; 1300-30 1500-1530, 1700-1830 on 15175, 325, 21670, 217303; 1900-2030 on 11850 175, 17825, 21670; 2100-2230 on 11850, 175, 17825 and 2130-0030 on 9550, 10, 11950KHz. The transmission at 45GMT is the one directed to Australia d New Zealand.

PEI in Taiwan has transmissions to rope from 1530 to 1800GMT, and uses 30, 9685, 9765KHz. The station also s 11725, 11825 and 15125, 17890 for "Voice of Free China" transmission. glish is 1530-1610, Arabic 1615-1645, ench 1645-1715 and Cantonese 1715-00.

DX INTERNATIONAL SURVEY AWARDS

In the July issue we gave details of the Broadcasting Awards being made by DX International of Boston, U.S.A. The response from our readers to this survey was excellent.

In a letter, David Wilson, who is in charge of the international survey, said the organisers extended the most sincere and heartfelt appreciation to all "ELECTRONICS Australia" readers who participated in the survey and to "ELECTRONICS Australia" for its genuine interest and generous assistance in making the survey the most successful yet.

Over 60 countries participated in the survey. Listeners in these countries sent in their preferences for the various categories in the contest. The complete survey covers over 100 stations in the popularity field, and top placings were:

Most Popular International Short-wave Station, 1965-66.

Radio Netherlands, Hilversum, 1; Swiss Broadcasting Corporation, Berne, 2; BBC, London, 3; Deutsche Welle, Cologne, Germany, 4; Radio Prague, Czechoslovakia, 5; CBC Montreal, Canada, 6; WNYW, New York, 7; Voice of America, 8; Radio Sweden, Stockholm, 9; Radio Portugal, Lisbon, 10; Radio Australia, Melbourne, 11; Radio Japan, Tokyo, 12; HCJB, Quito, Equador, 13; Radio Budapest, Hungary, 14; Radio Moscow, USSR, 15; Radio Havana, Cuba, 16; Radio Nacional, Bogota, Colombia, 17; Radio Berlin, DDR, 18; Radio New Zealand, Wellington, 19; and Cairo, 20.

Most Popular DX Session.

Radio Sweden 1; Radio Netherlands 2, Radio WNYW New York 3; Radio Budapest, 4; Radio Portugal, 5; Radio Australia, 6; Radio New Zealand took 13th place.

Outstanding News Coverage.

Voice of America, 1; BBC London, 2; Radio WNYW, 3; Swiss Radio, 4; Radio Sweden, 5.

Music and Variety Programs.

Radio WNYW, New York, 1; BBC London, 2; Radio Netherlands, 3; Swiss Radio, 4.

BROADCAST BAND NEWS

STRALIA.—The Postmaster-General's rtment has placed an order with RCA ustralia Pty. Ltd. for aerial systems eceiving equipment for the Radio Aus- booster station being established on Peninsula, near Darwin. The order, $1.465 million, covers design, supply installation.

nouncing the order, Postmasterral Alan Hulme said the Darwin Boosation was scheduled for operation in 1968. Programs from Radio Australia epparton in Victoria would be received booster station and retransmitted to improved program transmissions into -East Asia and other Asian areas, Mr e said.

STRALIA—Latest new A.B.C. staon the air, 6ED Esperance, W.A. 0KHz has a power of 1,000 watts. er stations for Port Hedland, Broome, n the northern area of the State, are ted. The new Port Hedland station pected to come into service about iddle of 1967. Derby is to have a , also Bussleton, in the south-west .A. This information comes from . R. Channell, Manager for West lia for the Australian Broadcasting ission. The mailing address for all s is G.P.O. Box D190, Perth.

I—The Fiji Broadcasting Commission ade a frequency change for its VRH3 a station, which for some years has operated on 890KHz. The station is now on 1320KHz the frequency which was formerly used by VRH11 as an alternative frequency, which at times carried sporting and other special event programs. The Suva station VRH is now on 560KHz and VRH2 uses 710KHz. VRH has English programs which are also carried on VRH3 at certain times, while VRH2 has the vernacular service.

NEW ZEALAND—Reception of the N.Z.B.C. all-night transmissions is reported by some Australian readers, who hear the services very well. The stations on the 24-hour-a-day service are 2YA Wellington 570, 4YX Alexandra 640, 3YA Christchurch 690, 1YA Auckland 760 and 4YA Dunedin 780KHz. The stations are silent Sunday 1120 to 1700GMT (11.20 p.m. to 5 a.m. Monday N.Z. time). Reception of 3YW Westport on 1460KHz is also reported at 1700GMT by Graham Rostrom, Fivedock, N.S.W.

The 46th New Zealand station opened on October 1, when station 1ZU Taumarunui opened on 1520KHz using the power of 1KW. The station located in the centre of the North Island, will carry some commercial programs, but will mainly carry the National program of the N.Z.B.C. into the area. Its schedule is 6 a.m. to 11.20 p.m. N.Z. or 1800-1120 GMT, when almost the complete program is a relay of the National Service. This leaves only one further station to come into operation in New Zealand, a repeater of the N.Z.B. C. program for Whangarei, Northland, but details on this station's call and frequency have not been announced. ■

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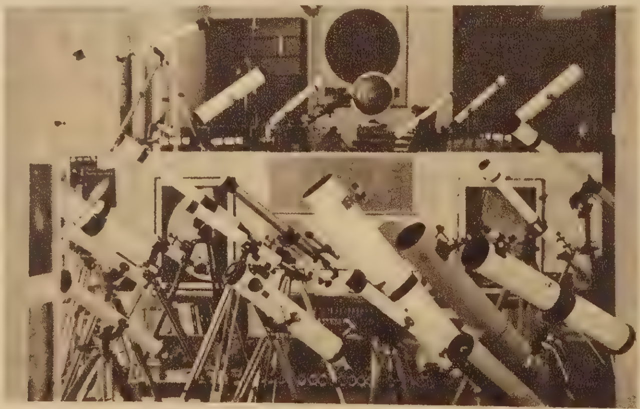

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RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the manufacture of television and radio receivers and can offer same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, $9.00 per 100. **Our price, $2.00 per 100.**
Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values.
List price, $11 per 100. **Our price, $2.06 per 100.** Post and packing, 35c extra.

The potentiometers are all current types and include switch pots, dual concentric and T.A.B. pots.
List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G, 6X5GT or IT4 as advertised on this page.

Imported National Transistorised Shoulder Megaphone

These shoulder megaphones manufactured by National Radio Japan have an output of 4 watts, and are supplied complete with inbuilt horn type speaker, batteries and microphone. List price $78.

Special Price $50. Post extra.

Other types also available.

NEW AMERICAN TWIN TELESCOPE TV AERIAL

Extends to 36in each sect can be used singly for car portable $1

Post 20c.

NEW 4" EXTENSION SPEAKERS

These 4" speakers are mounted in polished cabinets suitable for use as intercom. units or extension speakers.

LIST PRICE .. .. $12.

SPECIAL PURCHASE ENABLES US TO SELL THESE UNITS AT $4. Post and packing, N.S.W., 68c. Interstate, 98c.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Cry Pick-ups and Sapphire Styli have just been superseded. We are sell some at LESS THAN HALF PRICE. Available in STEREO $25.50. POST AND PACKING EXTRA, N.S.W., $1.50; QLD., VI TAS., $2.25; W.A., S.A., $1.30.

USED HIGH-SPEED 240V. AC/DC MOTO

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed 7.000 R.P.M. and are ideal for small drills, grinders, etc. Dimensi 5½in x 3½in, with 5/16in spindle .. ..
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NEW 4-SPEED STEREO PLAYER F.O.R. . $17.50 (£8/15/)

NEW STEREO CHANGER. 4-SPEED F.O.R. .. $21.50 (£10/15/)

SLIDER-SWITCHES
10 pole 2-way silver plated contacts

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Prim. 240V Sec. 350 volts a side. One 6.3V, one 5V Fil.

$2.75 Post N.S.W. 60c, Interstate 80c.

LEADER SIGNAL GENERATOR LS

240V A.C. operated, 6 band 120KC to 390
Provision for crystal.
Post N.S.W., 75c; Interstate, $1.25. $29

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volt, with circuit for charger, $4.75. Post, N.S.W., 75c; interstate $1.00.
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NEW 240V. A.C. MOTORS

These small motors, size 5in x 3in x 3½in, are 1-12 h. but are only suitable for intermittent use. $2.95. P N.S.W. 35c; Interstate 50c,

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

- **3-speed 1⅞, 3¾, 7½.** ● **Pause control.** ● **Takes 7in. spools.**
- **Simplified controls, 4 Track, $48; 2 Track, $44, OSC Coils, $1.50**

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital coun and will take 7in spools.
2 Track, $35.50, 4 Track 45.25.

NEW "TECH" V.T.V.M. MODEL TE65

23 RANGES. 240V. A.C. powered.

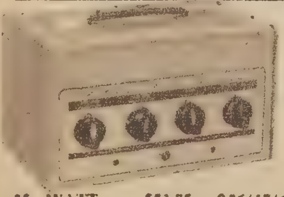
D.C.V. 1.5, 15, 50, 150, 500, 1,500
A.C.V. 1.5, 15, 50, 150, 500, 1,500.
D.B. —10db to +60db.
Resistance. 1 ohm to 1,000 megohm.

$42.50 POST $1.00

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USB WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October. Electronics Australia complete with kit of parts including transistors mono **$7.50**, stereo **$13.00**, 240 power supply for above **$7.00.**



25 WATT .. $53.75, £26/17/6
17 WATT .. $43.75, £21/17/6
Post Extra on 15 Watt
N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air.
Too Heavy, for Post.

NEW 17 & 25 WATT P.A. AMPLIFIER

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as mi phone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 oh

The 25 watt amplifier can be supplied with line output transformer tapped from 100 to 600 ohm required at 20/extra.

Inputs provided for microphone, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) .. .. $6.75 .. 6

Crystal Microphones for amplifier .. .. $4.75 .. 4

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EW AMERICAN TV POWER BOOSTER UNIT AT LESS THAN HALF PRICE

$9.75 (£4/17/6) POST FREE

(EX LIQUIDATION STOCK H. G. PALMER)

These TV POW-R boosters can be used in two ways. Firstly as a "straight-thru" circuit giving extra boost to the TV signal for improved performance on one receiver.

Secondly to boost signal strength to two or three TV receivers coupled to the one aerial.

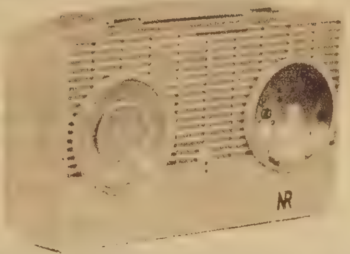
Full instructions supplied with each unit. 240 volt A.C. operation.

SPECIAL — OFFER

Complete KIT for TRANSISTOR 6 PORTABLE $17.50

The complete kit of parts for the transistor six includes six transistors, printed ircuit board, coil kit, 4in speaker, Ferguson driver and output transformers, eavy duty battery and all necessary parts to complete the set with full in-tructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Pack: extra. N.S.W., $1.00, Inter., $1.30.



NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	55c
XA102	OC44	Osc. Transistor	75c ea.
XB103	OC75	AUDIO general purpose	75c

Ducon type SFT 123 equiv, OC74 .. .. .. 75c ea.
Available in matched pairs at .. .. $1.50 pair
AUDIO OUTPUT
Post and packing on transistors 15c any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturers stock E.H.T. units $5.00. Deflection yokes $5.00. Post free

NEW VALVES AT BARGAIN PRICES

1A7GT	95c	3S4	$1.00	6K7G	45c	6SN7GT	95c	1L5G	95c
1C7G	30c	5V4G	$1.00	6K8G	68c	6SS equiv. 6SK7.	85c	12A6	80c
1D8GT	95c	6B8	$1.00	6Q7G equiv, 6B6G	$1.00	6U7G	45c	12SK7	50c
1K5G	40c	6C8G	80c	6SA7GT	95c	6X5GT	75c	12SK8	80c
1K7G	49c	6F6	$1.00	6SH7	85c	7C7	35c	12SH7	60c
1M5G	40c	6H6G	35c	6SJ7	95s	12AT7	$1.00	866	1.50
1P5G	25c							954	25c
1Q5G	25c							955	25c
1T4	45c							7193	25c
3Q4	75c							EK32	68c
EF50	45c								

Please add postage on all valves.

EW 4-SPEED STEREO & MONO PLAYERS
AT LESS THAN HALF PRICE

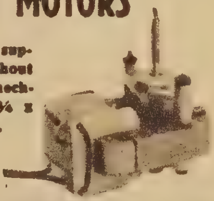
PHILIPS 4-SPEED
6V BATTERY PLAYER
MONO $9.75
STEREO $11.75

Post and Packing, N.S.W., 75c.
Post and Packing, Inter., $1.25 Extra.

NEW 240V. ELECTRIC MOTORS

3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

$2.75



NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim. Supplied with 5in x 7in speaker in felt-lined enclosure Space for amplifier and batteries or power supply.

Dimensions: 15in x 13in x 7in.
Post and Packing: N.S.W., 90c; Interstate, $1.20.

$11.50

NEW MULTIMETER—$5.25

POST EXTRA
METER 0-1MA 1,000 OHMS PER VOLT
A.C. RANGES D.C. RANGES CURRENT
SUPPLIED COMPLETE WITH TEST LEAD
RANGE 0-100,000 OHMS

0—10v	0—100v	0—500v	0—500MA
0—50v	0—10v	0—1000v	
0—250v	0—50v	0—1MA	
0—500v	0—250v	0—100MA	

EXTENSION SPEAKERS

$8.50

New 9 x 6 speakers in case.
Post: Interstate, 55c; N.S.W. 40c.

EW POWER TRANSFORMERS

nA prim.: 240v with 230v tapping Sec. x 285 with 6.3v filament winding. nA, **$3.00.** Plus Postage: N.S.W., 35c; rstate, 52c.

m.: 240v, Sec. 385 x 385 at 80mA, fil. and 5v, **$4.50.** Post.: N.S.W., 40c; rstate, 75c.

A H.T. Chokes, 75c. Post.: 20c.

T.M.K. MULTIMETERS

Before buying see our range of T.M.K. test instruments. As advertised in April issue of Electronics Australia.

NEW MIDGET POWER TRANS.

40mA prim., 240v. Sec 225 x 225 with 6.3v. Fil. Winding.

$3.25 Postage: N.S.W.., 25c; Interstate 45c.

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

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TRANSISTORISED SIGNAL INJECTOR, $5.50

A MUST FOR QUICK TROUBLE SHOOTING

Using TWO Transistors, complete with instruction sheet and battery. Post free.

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ALL TYPES OF TUBES AVAILABLE EXCEPT BONDED

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Second Quality
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27 inch $20 plus dud
All prices cash or COD

THESE ARE
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FULL WARRANTY:
Any tube returned to Sure Brite under warranty is replaced with another one at no extra charge. regardless of whether it tests good or not, so long as it is not broken.

COUNTRY CUSTOMERS
Rail tubes to Lewisham Station, freight paid. Orders filled same day received. All freight charges to be paid by customer.

LARGE STOCK
We always have all types in stock, except bonded. When ordering state which price tube you want, otherwise the $12 tube will be supplied.

DELIVERY
Free delivery on tubes, same day inter suburbs only

SECOND QUALITY TUBES
Some Second Quality Tubes at only $8.00 plus dud.

DUDS
Must be under vacuum and scratch free.
We can sell 17 inch without dud for $6 extra
21 inch without dud for $8 extra.

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We can supply tubes with 12 volt 300ma heater

Sure Brite Picture Tubes

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LOCATION: Initially in Melbourne but to transfer to Sydney, mid January, 1967. Transfer to Sydney will be made at Departmental expense. Travelling Allowance will be payable to successful applicant whilst located in Melbourne, except Melbourne residents.

APPLICATIONS: To reach,

THE SECRETARY.
DEPARTMENT OF THE NAVY,
CANBERRA, A.C.T.

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Perth : Telephone 391521
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TECHNICAL BOOKS AND PUBLICATIONS

nciples of Linear Circuits

ICIPLES OF LINEAR CIRCUITS, by E. A. Faulkner, M.A., Ph.D. Published bv Chapman and Hall Ltd., London, 1966. Hard covers, 116pp., 5¼in x 8½ in, many circuits and diagrams. Price in U.K. 25/ stg.

An up-to-date book on linear circuit y, written mainly for senior-year physics and engineering students but also suitable for engineers, technicians and interested hobbyists as a reference. The author is presently Senior Lecturer in Physics at the University of Reading, before that being a research fellow at C.S.I.R.O. in Melbourne.

Although a relatively small volume the book gives a coverage of linear circuit theory both ssuming a good general physical and matical background and by virtue of aulkner's terse but lucid style. In he book is something of a paradigm terary economy; a most refreshing in view of the current emphasis on ity rather than quality.

he chapters are headed as follows. ircuits — Principles of AC Circuits— er AC Circuits — Principles of Amplifiers—Negative Feedback. An appendix deals with noise in amplifying systems.

Throughout, the approach is in keeping with modern developments in components and techniques. Thus the chapter dealing with amplifiers uses silicon junction transistors as a basis for almost all the discussion, and this is also done with the feedback chapter. In treating 4-terminal parameters Dr Faulkner similarly ignores little-used parameters and concentrates on those of the hybrid-h and admittance matrices.

In short, an excellent little book on linear circuit theory and one which seems eminently suitable for use as a university and college text.

Our copy came direct from the publisher, who supplied no details as to local price and availability. However as the U.K. publication date was in late August, copies should be available in local bookshops shortly if not at present. (J.R.)

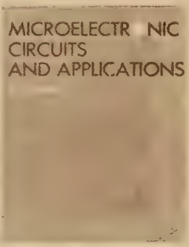
Microelectronics

MICROELECTRONIC CIRCUITS AND APPLICATIONS, by John M. Carroll. Published bv McGraw-Hill Book Co. Inc., New York, 1965. Hard covers, 360pp., 11 x 8in, many photographs and diagrams. Price in Australia $10.25.

A further volume in the McGraw-Hill series of electronic reference anthologies, compiled from articles recently published in their journal "Electronics." The editor is John M. Carroll, formerly managing editor of the journal and editor of previous anthologies in the same series.

As the title indicates, the present volume deals mainly with microelectronic circuits, techniques and applications. It begins with four introductory chapters by the editor, surveying the types of microelectronic circuitry currently in use or development, and follows with some 78 relevant articles published over the period 1963-64.

The articles are grouped in chapters, with titles as follows. Introduction to Microelectronics—Nonlinear Integrated Circuits — Linear Integrated Circuits — Active Thin-Film Circuits — Passive Thin-Film Circuits — Micromodules — Composite Semi-conductor Components — Optoelectronic Circuits — Micropower Circuit Techniques — Cryogenic Circuits — Field-Effect Devices and Applications — Unconventional Semi-conductor Components.



MICROELECTR NIC CIRCUITS
AND APPLICATIONS

As with the previous books in this series the articles are virtually as originally published, and are all of the high standard usually attained by "Electronics" articles. The introductory chapters are terse but quite informative. The volume should thus make a worthwhile addition to the reference shelf of any engineer, technician or advanced amateur wishing to keep up to date with modern techniques and devices.

Our copy came direct from the publisher, but we understand that copies may be obtained from all comprehensive booksellers. (J.R.)

★ ★ ★

PRINCIPLES OF AERIAL DESIGN, by H. Page, M.Sc., M.I.E.E. Published by Iliffe Books Ltd., London. Australian price $7.80.

RELIABILITY OF ELECTRONIC COMPONENTS, by C. E. Jowett. Published by Iliffe Books Ltd., London. Australian price $6.60.

FEEDBACK CIRCUIT ANALYSIS, by S. S. Hakim, Ph.D., B.Sc., A.M.I.E.E. Published by Iliffe Books, London. Australian price $16.60.

TRANSISTORS FOR TECHNICAL COLLEGES, by L. Barnes, M.Sc., Tech., A.M.I.E.E. Published by Iliffe Books, London. Australian price $6.60.

We have now received bound copies of these four books, which were reviewed in our May and June, 1966, issues when rough proof copies were submitted by Technical Book and Magazine Company, 295-299 Swanston Street, Melbourne. The company advises that they are now holding stocks of these works.

★ ★ ★

MEASURES FOR PROGRESS: A History of the National Bureau of Standards. Published in the U.S.A. by the U.S. Department of Commerce, and available from The Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price in the U.S.A. $5.25. Add 25 per cent for post and packing.

No review copy of this publication has been received, and the following information has been extracted from a news sheet received from N.B.S.

This says: The critical role played by the National Bureau of Standards in this country's amazing growth in technology, industry, and commerce is described in a 700-page history of the Bureau just released by Secretary of Commerce John T. Connor.

Written by historian Dr Rexmond Cochrane under the editorial direction of the late science-editor James R. Newman, the book recounts authoritatively the 65-year history of the N.B.S.

The new book is packed with anecdotes of some of the great and world-renowned scientists, many of whom were interviewed

Binary Arithmetic, Boolean Algebra

RY ARITHMETIC AND BOOLEAN LGEBRA, by Angelo C. Gillie, 1965. IcGraw - Hill Book Co., Inc., New ork. Cloth bound, 6in x 9in, 248pp., any diagrams. Price in Australia $6.85.

many engineers, technicians and ad- hobbyists will no doubt be aware, circuitry and techniques are becom- ore and more often used in modern nics. And for a clear understanding operation of such circuitry, it is al- ssential to have a reasonable grasp concepts of binary arithmetic and n algebra. This is particularly the one is destined to engage in design evelopmental work.

growth of digital technology being ly recent, few engineers or technicians eceived formal training or education e fields. Thus for most, the concepts ve to be acquired from on-the-job e-time reference to books and maga- ticles. The same situation will apply nced hobbyists, in most cases.

rtunately to date there have been ly few suitable books available on stralian scene; and while there have nany relevant papers and journal these present inevitable problems of nd follow-up access. In view of this sent volume should be of consider- terest.

author is professor of Electrical logy at Niagara County Community , New York. Not surprisingly, there- e book has a practical electronic ion, in contrast with the somewhat ic logico-mathematical orientation ound in such books. To most elec- eople this will no doubt be an im- point in its favour.

Even a cursory inspection reveals that the coverage is quite comprehensive. Starting with concepts of number and numbering, the author moves first to codes, then to binary arithmetic. Then follows the introduction to Boolean fundamentals, followed by a discussion of circuit simplification techniques using topological diagrams, truth tables, matrices, and maps. The final chapters deal with circuit synthesis and the techniques of minimalisation.

As with all books dealing with fairly abstract and involved concepts it is rather hard to reach a decision about the depth of treatment and the effectiveness of exposition. I would say that the book is quite good in these respects; certainly it is better than many I have seen. But I feel duty bound to add—for what it's worth — that I think there is still plenty of room for improvement.

Not that I can direct readers to a book which is markedly superior; I can't. But what I do suggest is that for a really good grasp of these concepts it is advisable to refer not to one, but to many books. And the present volume certainly qualifies for inclusion on the list.

Our copy came direct from the publishers, but we understand that copies are available at all major booksellers. (J.R.).

Automatic Taped Background Music Systen

Continuous Cassette type 1-4 hours.
All tapes available for sale or hire.
Hire charges on application.

$170.00 per unit plus tax

STOCKTAKING SPECIALS

Medding Stereo 8/8 amplifiers	$52.00 plus tax
Dust bags	$2.00 plus tax
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A.S.T. 5 valve radiogram chassis comp with 12 in. Rola speaker and dial glass line) our guarantee applies $36.00 plus

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PRECISION ELECTROACOUSTIC EQUIPMENT

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TRUMPET

HD. 210/P

Low frequency cut-off	350 Hz
Sound distribution	120 deg
Air column length	350 mms
Power rating	6 watts
Watts peak	15 watts
Impedance	16 ohms
Frequency response	350 ÷ 10000 Hz
Maximum diameter	210 mms.
Maximum length	210 mms.
Weight	1,300 grs.

Price Retail £12-16-0
Plus Sales Tax £1-6-8

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TAS.: Homecrafts-Tasmania, 199 Collins St., HOBART. Nichols Radio, 91 Wellington St., LAUNCESTON.
QLD.: T. H. Martin Pty. Ltd., 35 Charlotte St., BRISBANE.
N.Z.: P. H. Rothschild & Co. Pty. Ltd., 83 Pretoria St., LOWER HUTT. P.O. Box 30/170.

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MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

this history. It includes details of some the significant inventions credited to the reau of Standards.

"Measures For Progress" describes how neon sign was invented; how the S.A.'s optical glass industry was born; v the weight of hydrogen was determined h all its implications in an atomic age; w Standards research put radio into ery home; how it succeeded in putting ection-finding radios in aircraft; the velopment of the magnetic fluid clutch it became a multi-million dollar indus-; the development of World War II oximity fuse which contributed greatly to ied victory; and the development of the vy "Bat," the first guided missile used warfare.

TERATURE—in brief

NDUSTRIAL RESEARCH NEWS, Sep-ber, 1966 (published bi-monthly by .I.R.O.) has news about scientific instru-nts developed in the C.S.I.R.O. Division Chemical Physics which are to be pro-ed in a new factory being established Victoria by Perkin-Elmer Pty. Ltd. tails are given of a mass spectrometer k detector.

)ther articles are: "Rigid Houses," which cribes new techniques for building houses eliminate cracking due to clay subsoil vement; "Blue Ribbon," referring to the ard by "World Mining" of its Blue bon in the control and laboratory equip-nt category to C.S.I.R.O.'s Cyclosizer for ticle size analysis; "Filter Aids," describ- a process of making filtering material n coal, developed at C.S.I.R.O.; "Freeze ing," about a method of preserving food-fs and a new system developed by a .I.R.O. scientist for reducing freezing e; "Potential Determined," concerning a instrument for determining soil mois-.

his publication is available free, and iiries should be addressed to Industrial Physical Sciences Branch, C.S.I.R.O., Albert Street, East Melbourne, C2, Vic-a.

IULLARD BULLETIN, published in U.K. by Mullard Limited, has informa- about the following Mullard products: per-doped germanium infra-red photo-ductors; YK1070 series of 1W communi-ons reflex klystrons with 5,000 hours anteed life; Types WF3806 and WF3811 sformers for transistorised thyristor g circuits; Types XP1113 and XP1114 tomultipliers; Types BSX19 and BSX20 silicon planar epitaxial transistors for -speed logic switching circuits or HF lifiers; Type BYX30 fast recovery silicon fier diode; industrial magnetrons with er outputs from 200W to 5KW; Type 5011 thyristor firing module; high-gain N silicon planar transistors with inte-ed circuits for TV IF amplifiers; per-ent magnets for use with reed switches; EE1035 12in electromagnet; Types 037 and EE4038 solid state power units 9in and 12in electromagnets; YD1170, and 1172 15KW ceramic triodes for strial heating; new marine radar netrons; MY5051 current limiting and suppression module; high voltage n rectifier assemblies; silicon voltage lator diodes; BLY17 silicon planar istor for HF transmitters; BYX25 W avalanche power rectifiers; new high ge controlled avalanche thyristors; le diffused silicon transistors; power for ultra-high-vacuum pumps. Also ded is a section with news of company ity in various fields. (Inquiries should ent to Mullard-Australia Pty. Ltd., 35-43 nce Street, Sydney.)

MERSON AND CUMING INC. on, Massachusetts, U.S.A., has prepared ick reference chart for notebook use wall mounting describing the most rtant members of the company's Stycast ng and encapsulating resins. The chart ranged in groups of similar products onvenience in use.

The mix preparation and handleability are briefly indicated together with the cured characteristics. Electrical properties, thermal properties, strength and hardness are included as well as photos demonstrating many applications. The number of the appropriate technical bulletin which describes each product in detail and how it is used is listed.

Inquiries should be sent to the company's agents, Wm. J. McLelland and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.

AMALGAMATED WIRELESS VALVE COMPANY PTY. LTD. has prepared a retail price list of some 800 valves. Copies of the list are available on application to the company's head office at 348 Victoria Road, Rydalmere, N.S.W.

ROLA DIVISION of the Plessey Components Group has available a catalogue and price list of the standard and stock types of aluminium-nickel-cobalt magnets made by the division. This contains dimensional details of the different sizes of magnets available in various configurations, with the appropriate type number, and supplementary information about the qualities of aluminium-nickel-cobalt. Inquiries may be addressed to the company's head office, The Boulevard, Richmond, E.1, Victoria.

R. H. CUNNINGHAM PTY. LTD., 8 Bronham Place, Richmond, E.1, Victoria, has been appointed Australian agent for A. F. Bulgin and Co. Ltd., the U.K. manufacturer of electronic and other components. A bulletin describing some of the recent additions to the company's range of components is available on request from the address given above, or from other branches of R. H. Cunningham.

MINIWATT DIGEST, Vol. 5, No. 12 (September, 1966) contains an article entitled "Philips Electronics Trainer Systems," which describes a dual system of electronics trainers, based on the concept of integrating theory with practice. It comprises a "Master Trainer" and a "Student Trainer," and the system may be adapted to any level of teaching up to university level.

In the same issue is Part 2 of an article entitled "Electronic Flash Circuits." This gives details of two transistorised designs, with constructional information, performance figures and component sources.

"Miniwatt Digest" is published by the Miniwatt Electronics Division of Philips Electrical Pty. Ltd., 20 Herbert Street, Artarmon, N.S.W., the subscription rate being $3 per volume. Single copies are available for 50c each.

STANDARD TELEPHONES AND CABLES PTY. LTD. can supply a 10-page manual listing the comprehensive range of ITT Intermetall zener diodes the company now stocks, and also containing technical data, operating characteristics and dimensional information of the various configurations manufactured as well as a replacement guide giving cross listings against other makes of zener diodes.

Inquiries should be sent to the company's head office at Moorebank Avenue, Liverpool, N.S.W.

STANDARDS ASSOCIATION OF AUSTRALIA is seeking comment on a draft Australian standard for dry primary cells and batteries, issued as Doc. 1083. The draft deals with the types of primary cells and batteries applicable for Australian use, and in its preparation account has been taken of relevant American and British standards as well as publications of the International Electrotechnical Commission.

Standard sizes and cell arrangements are given for zinc carbon, mercuric oxide, silver oxide and alkaline manganese dioxide types. Terminal facilities are specified as well as overall dimensions and some design and constructional features.

Batteries are classified for specific purposes such as telephone and light intermittent use (Type R40 cells), general-purpose lighting, industrial lighting, hearing aids, low current application (multi-cell), solid state devices other than hearing aids, photographic equipment and safety lights (flashing), and appropriate tests for capacities are specified.

Copies of Doc. 1083 may be obtained without charge from the headquarters of the association, 157 Gloucester Street, Sydney, or from branch offices in capital cities and at Newcastle. Comment should reach the association not later than December 31, 1966.

STC COMPONENTS AND APPARATUS REVIEW, Vol. 3, No. 8 (August, 1966) has descriptions of the following products: Silicon avalanche rectifiers; ITT-Standard shaded pole asynchronous motors, Series EM 3; deposited carbon film resistors; solid tantulum capacitors; dry and mercury wetted reeds and relays. (Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W.)

AUSTRALIAN GENERAL ELECTRIC PTY. LTD. has limited stocks of a revised edition of "Major Specifications of General Electric Semiconductors," published in the U.S.A. by the General Electric parent company. This very comprehensive 56-page manual is lavishly produced on high quality paper and printed offset in three colours. Requests for copies should be on company letterhead, and addressed to the A.G.E. head office at 103 York Street, Sydney.

HEWLETT-PACKARD JOURNAL, Vol. 17, No. 11 (July, 1966) has a main article entitled "A Sensitive New 1GHz Sampling Voltmeter with Unusual Capabilities" which describes a voltmeter operating on the principle of incoherent sampling which measures over wide frequency and voltage ranges while providing an output usable for signal analysis.

Other articles in the same issue are: "Measuring Attenuation, SWR, and Substitution Loss with a Low-noise, High-precision SWR Meter," in which effects of noise and other factors are presented for an improved SWR meter used with crystal and bolometer type detectors; "Increasing Instrument Sensitivity with a Low-noise Preamplifier," which suggests a number of applications in which measurements are simplified by a low-noise wide-band amplifier.

Inquiries should be addressed to the Hewlett-Packard agents in Australia, who are Sample Electronics (Vic.) Pty. Ltd., 9-11 Cremorne Street, Richmond, Victoria.

AUSTRALIAN GENERAL ELECTRIC PTY. LTD. has asked us to point out that copies of the three manuals published by the company (Transistor Manual — Silicon Controlled Rectifier Manual—Essential Valve Characteristics Manual) are now available from the following bookshops:

Dymocks Book Arcade Ltd., 428 George Street, Sydney.

Standard Book Suppliers Pty. Ltd., Elizabeth House, 213 North Terrace, Adelaide.

Barkers Wholesale Pty. Ltd., 68-70 Albert Street, Brisbane.

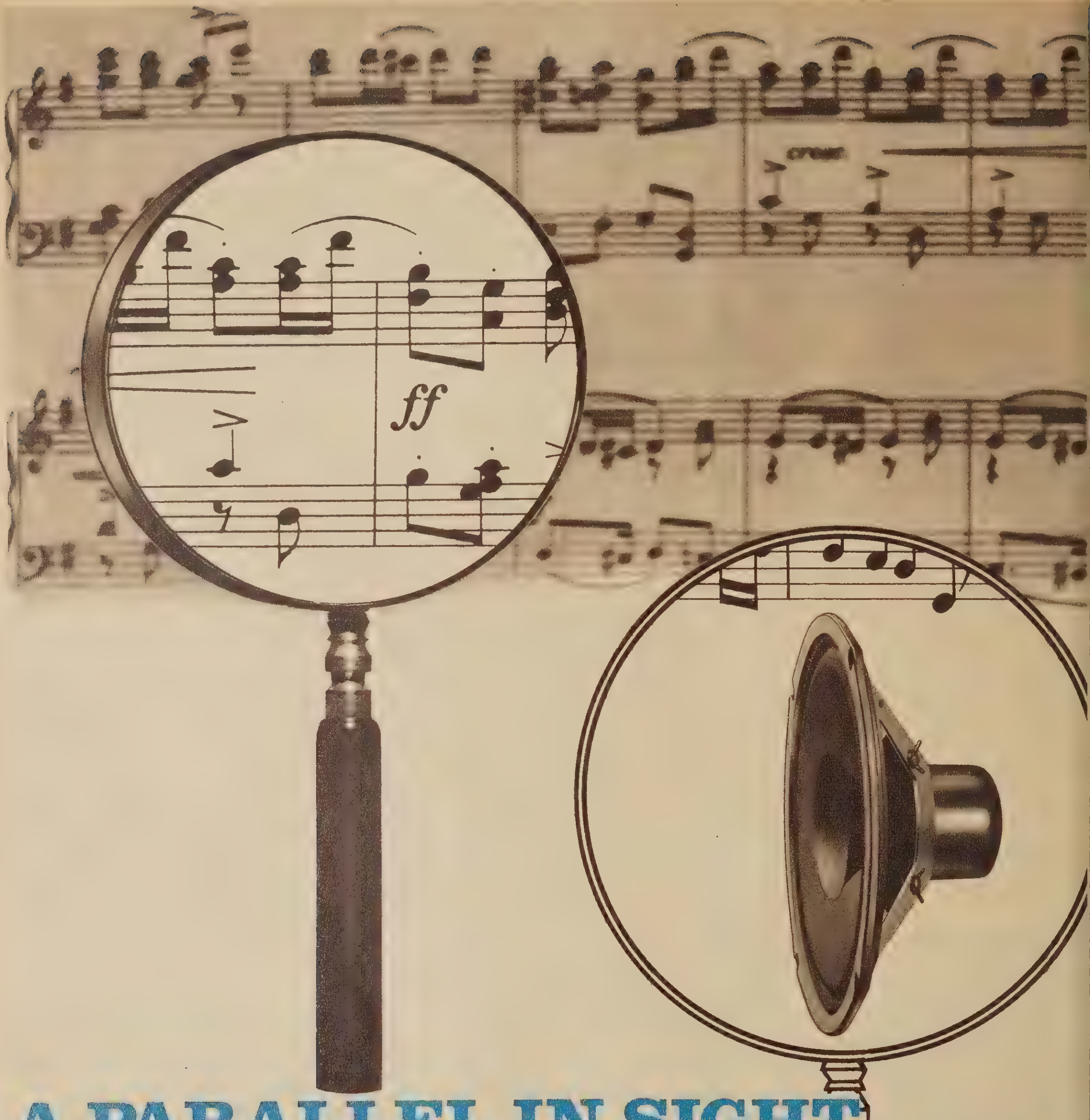
Collins Book Depot Pty. Ltd., 363 Swanston Street, Melbourne, C.1.

Technical Book and Magazine Co., 295 Swanston Street, Melbourne, C.1.

Readers requiring these manuals should therefore address their inquiries to these bookshops.

A.G.E. also advise that their other manuals (Hobby Manual — Glow Tube Manual — Rectifier Guide) are out of print and present indications are that there will be no further supplies of these.

AMALGAMATED WIRELESS VALVE COMPANY has published a four-page brochure entitled "Educational Aids" containing details of various apparatus and literature the company can supply to educational establishments for electronic training; also a four-page brochure giving full technical details of the company's Super Radiotron 25TP4 television picture tube. These are available free and post free from the company's head office at 348 Victoria Road, Rydalmere, N.S.W.



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Wireless (Australasia) Ltd., 123 Murray Street. Phone 3 3836. LAUNCESTON: Amalgamated Wireless (Australasia) Lt
Cameron Street. Phone 2 1804. ADELAIDE: Newton McLaren Ltd., 82 Gilbert Street. Phone 51 0111. BRISBANE: Chan
Ltd., Albert and Charlotte Streets. Phone 31 0341. PERTH: Amalgamated Wireless (Australasia) Ltd., 335 William S
Phone 28 3425.

ANSWERS TO CORRESPONDENTS

ıen writing to us:—
'lease give your name and
ull postal address, includ-
ıg the State . . . N.S.W. &c.
/rite the above information
learly or, for preference,
rint it in block letters. Your
o-operation will facilitate
elivery of replies by mail,
here such are called for.

TRANSISTOR SYMBOLS

(Waverley, N.S.W.) writes to con-
atulate us on the interest level main-
ned in "ELECTRONICS Australia"
t points out the difficulty he has in
nembering transistor connections,
. He suggests that we might be able
publish them in the form of a border
sign so that they would be there in
ery issue of the magazine!

n't seriously feel that our role is to
ed symbols and connections in each
ery issue. And, after all, why stop at
ors? What about valve sockets, RMA
codes and sundry other data? This is
where individuals have to look after
ves by systematically collecting or
ıg data, handbooks, etc. The other
putting a different item on "Answer
blackboard each issue would be
ouble than it would be worth. The
ce constant" of having to change the
each month would be quite high.

READER BUILT IT

(Corio, Vic.) says that he particu-
ly watches for the "Reader Built It"
tion and would like to see it expan-
l.

rge extent, the size of the section is
by the number and suitability of
tributions but we will keep in mind
preciative remarks.

SSB AND DSB

elgrave, Vic.) wants to become an
ateur operator and asks several rele-
ıt questions.

e a couple of articles in preparation
techniques which you might find
To study such subject, it is usual-
sary to pursue it in as many books
ırnals as are available to you. We
assist you at the moment with a
DSB circuit but the idea is worth
at. Sorry, but we can't help you
with a circuit for an RF power
r unit to follow your ex-disposals
ter. Regarding the Youth Radio
we suggest that you make contact
and the Wireless Institute through
eless Institute at P.O. Box 36, East
rne.

EASIER STARTING

Iapier, N.Z.) suggests that it should
possible to devise a transistorised
rter which could be introduced to
st the ignition coil voltage during
starting operation, and therefore
e for easier starting in cold weather.
thinks that it would be cheaper than
alling full-scale transistorised igni-
.

ıd foremost, cold starting charac-
are only one of the minor factors
storised ignition. The benefits norm-
ght are more consistent spark at
ine speeds and lowered point wear.
ıs your suggestion is concerned, we
at all certain that it could be as
ıs you suggest. DC/DC inverters
horrible habit of ending up much
mplicated than they start out to be.

A further point is that the current through the coil, with points closed and at elevated voltage, would be quite high. It would seem that the much more practical scheme is the old one of operating a lower-voltage coil through a series resistor, which is simply switched out when the start button is pressed. We are glad to note that you like the format of our articles and, in particular, the "serviceman" feature. No, there is no sliding scale for advertisements in relation to the content. Once an advertiser buys space, he virtually owns it and, within the bounds of good taste, can use it in any way he sees fit.

TRANSISTOR IGNITION

M.C. (South Wallsend, N.S.W.) asks what has happened to transistor ignition, which we haven't mentioned much of late. And what about capacitor discharge ignition?

The main reason why we have not said much about transistor ignition is largely that we covered it so thoroughly in the first half of 1964. Any readers who might have wanted to know about transistor ignition, or build themselves a unit, have been well served and there is no point in saying the same things all over again. Part of the early flurry about transistor ignition was due to the extravagant claims that were made for it, particularly its alleged economy in terms of petrol consumption. In fact, it has little to offer in this direction, when compared with a properly adjusted conventional system. Its main advantages are the way the spark is sustained at high engine speeds and the minimal wear of the breaker points. It is up to individual drivers to make up their minds whether they consider these advantages important in their particular vehicles. An important consideration is in connection with new vehicles under warranty, where it might be argued by a diffident distributor that the fitting of a special ignition system relieves him of any liability in regard to engine performance because of its "non-standard" nature. We have not done any work with capacitor discharge systems but they have been the subject of a good deal of argument. They appear to have an outstanding ability to "fire" bad or dirty plugs; they are criticised as having poorer performance in the presence of unduly weak or rich mixtures, because the brief, high-intensity spark is less able to produce ignition. Undoubtedly, the continued popularity of the conventional system is its relative cheapness and its ability to meet the requirements of the "average" motorist. Other forms of ignition may displace it, however, in the course of time.

COMMUNICATIONS RECEIVER

A. L. (Auckland, N.Z.) says he has a prewar communications receiver and wonders whether the in-built Lamb noise silencer should be discarded for a modern, post-detector type. Also would cathode-injection system for the BFO obviate the need for a product detector?

The idea behind the Lamb circuit was sound and, if it is operating normally, there would appear to be every good reason to keep it. Post-detector diode clippers offer simplicity as their main advantage. We doubt whether the BFO injection system will have any bearing on the need for a product detector for SSB. Of greater concern is the question of whether the receiver will itself be adequate for this mode, on the basis of oscillator stability.

PUPPET TECHNOLOGY

D.N. (Stawell, Vic.) asks if we can supply further information on the application of electronics to puppet technology. D.N. refers to a short item in the Technical Review columns of a recent issue of the magazine.

We regret that we are unable to supply any more information on this subject, D.N. However, we are publishing this query in the hope that some other interested reader may have more information and may be able to help. The full address is D. Nicholson, 67 Wimmera Street, Stawell, Victoria.

DEAD LETTERS

We are currently holding the following letters returned to us by the postal authorities as unclaimed.

Mr I. R. Holmes, Room 38, "O" Block, Victoria Barracks, St. Kilda Rd., Melbourne, Victoria.

Mr K. Campbell, c/o Post Office, Madang, New Guinea.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service. Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of $0-20 (2/-). Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the $0-20 fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel. Where articles are not on file we can usually provide a photostat copy at $0-20 PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost $0-50 (5/-) each. Original photographs of most projects are also available, from $0-50 for a 6in x 8in glossy print, postage $0-08 (9d).

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

(9) We have no file of circuits for commercial radio or TV sets, etc.

(10) A fairly good range of back numbers is available. On issues up to 6 months old there is a surcharge of 5c (6d). On issues from 7 to 12 months old the surcharge is 10c (1/-). Over 12 months, it is 20c (2/-).

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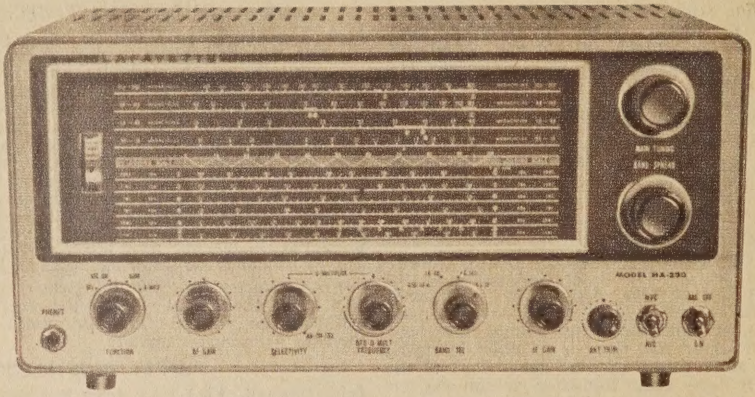
LAFAYETTE HA-230

in Kit Form



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A scoop factory purchase by LAFAYETTE makes possible this offer of a top quality receiver kit at such an incredibly low price. Successor to the popular HE-30, thousands of which are in use throughout the world, the HA-230 incorporates all the features of the HE-30 PLUS improved modern styling and a separate transformer to provide "always on" filament voltage for mixer and oscillator stages to give utmost frequency stability. An ideal receiver for amateurs and shortwave listeners.

The KT340 kit is complete in every detail. All major components are pre-mounted and step-by-step instructions are so easy to follow that wiring is a pleasure. Large pictorial illustrations show placement of all parts. IF an Coil Assembly are pre-aligned ready for operation, or if you wish, we shall make complete "Spot-on" alignment in our service workshop for a nominal charge.

4 BANDS—
- 550-1600KC (Broadcast Band)
- 1.6-4.8MC
- 4.8-14.5MC
- 10.5-30MC

- 9 Tube Superhet Circuit.
- 1 RF plus 2 IF Stages for High Gain Reception.
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- Calibrated Electrical Bandspread on Amateur Bands 80 to 10 Metres.
- 0-100 Logging Scale for SWLs.
- Effective Automatic Noise Limiter.
- AVC-MVC Selector on Front Panel.
- Stable Oscillator and BFO for Clear AM, CW and SSB Reception.
- Built-in Edgewise S-Meter.

Front Panel Controls: FUNCTION SWITCH, AUDIO GAIN, SELECTIVITY (Q-Multiplier), FREQUENCY (BFO), BAND SELECTOR, IF GAIN, ANTENNA TRIMMER, AVC-MVC SWITCH, ANL SWITCH, MAIN TUNING, BANDSPREAD TUNING, Headphone Jack.
Selectivity —60db at 10KC, 0.8KC at 6db (with Q Multiplier), Sensitivity 1.0 microvolt for 10db Signal to Noise Ratio, Output 1.5 Watts, Speaker External PM type 4 or 8 ohms impedance (Optional Extra). Tubes: 3-6BA6, 2-6BE6, 2-6AV6, 1-6AQ5, 1-5Y3, For 220-240 VAC.

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CLASSICAL REVIE

(Continued from page 12

works. These often pay tribute t
predecessor, the result of forma
fluences during apprenticeship
among composers of the first
second — rank there is, too, un
able signs of an original mind a
with a new statement to make.

Now it is quite obvious at firs
ing that the young Britten who c
ed the Sinfonietta for woodwin
ists and string quartet with added
bass was under strong Schonberg
fluence — the Chamber Symp
the work I have in mind—w
wrote his Opus 1. But what is
same time equally obvious is th
are many strongly personal ideas
is shown by the nature of the
itself and its extraordinarily clea
ed and logical development. And
tribute is paid to the Schonber
mentioned above, the stateme
made in a language the young
had already made his own.

At 19 Britten was displaying
gifts of melodic invention and te
skill far in advance of his years
work is enchantingly played by m
of the Vienna Octet and record
the freshest possible sparkle.

On the other hand the Hi
work came late in that co
career—1958. Hindemith worke
enormous industry and deployed
ly craftsmanship. He seemed t
with him an inborn gift for pol
writing that can be traced back
earliest works and is here a ma
clarity and ingenuity. But what
mith lacks, at any rate for me,
invention of attractive melodi
seem to come so easily to Bri
would not be too fanciful to
the Britten piece as the work of
and the Hindemith as that of
nessman with a flair for letter wr

Excellently played as it is here,
vides a splendid foil to the Sin
But I am very happy indeed to h
Britten.

MEASURING TIM

(Continued from page 29

together with two Racal RA.37 L
verters, these being in each case
the first to go into service an
The Observatory also relies upon
sion Frequency Standards suppl
Racal Instruments Ltd. Their o
fed to the Time Room, where it i
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dials in days, hours, minutes and s
They are the basis, too, of th
second-by-second ticks by which
tory domes work.

Two time systems are displaye
Time Room—universal and side
the difference between the two b
one part in 365.25 that repres
difference in defining the Earth's
respectively by the Sun and by th
The change from universal to sid
accomplished by phasing the st
through resolvers specially modi
the Observatory to eliminate
Correlation of time signals to rel
directly to astronomy is effecte
photographic zenith tube (PZ
scope.

CLASSIFIED ADVERTISING

vertisements in these columns cost $0.60 per line. Each line contains the equivalent of five words each of e letters. Minimum size of advertisements is two lines. Please note PAYMENT MUST ACCOMPANY ALL AD- TISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the December issue t reach our office before November 8th. Address your advertisement to the Advertising Manager, ELECTRONICS tralia, Box 2728, G.P.O., Sydney.

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Stereomaster cover microphones, speakers, ones, tapes. All as new. £255. Buckley, 1, ext. 365 (Sydney), 8.15 to 4.30.

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SITY Graham Supertester (valve tester). order, $25 or offer. 45 St. Paul's Randwick, N.S.W. Phone 39-1475.

your own transformers and save $$$s. te step-by-step detailed manual guides designing a transformer for any applica- Examples in manual include designing a eat soldering iron, trans. and power transformers, etc. Send $1 for your y return mail. Our new catalogue now samples of items stocked — electronic gears, pinions, PC boards, PVC, etc. A rgain at 70c. "CW NEWS/EEB," 12 $1. Sample club mags. and full club just 30c. All orders are sent by return C.W. Industries, 2-6 Ethel Street, bin, Vic. Watch us grow!

AST Receiver Booster Kit. This tran- d RF Amplifier will increase sensitivity, ty and sig./noise ratio of any transistor e receiver. No alterations to receiver ry—output of unit connects to aerial of receiver. Power gain 25dB. Ideal in f low signal strength or car radios. Stops Full price 35/. Hallard Electronics, P.O. , Campsie, N.S.W.

TOR 4-Receiver Kit. This is a very portable receiver using an efficient circuit employing voltage doubling etection, coupled to a high gain amp., put drives a 5 x 3 speaker producing a sound. The plastic cabinet is covered hite leather, which is very attractive. complete to the last screw, including on booklet. This set makes an ideal on at home or in the car. Wonderful Full price £7/2/6, or $14.25. Prompt Hallard Electronics, P.O. Box 58, , N.S.W.

ATT Hi-fi Transistor Amplifier. Distor- s than one per cent. Output power, 3.2 nto 15 ohm speaker: DC supply, 12V: y response, 30Hz to 18KHz, 3dB; mV, size, 3in long, 2in deep, 1in high. price 89/6, or $8.95. Hallard Elec- P.O. Box 58, Campsie, N.S.W.

AVE Receiver Kit. This kit has been for enthusiasts who enjoy listening to onal stations, hams, etc., on the 3.5- band. The kit is complete and includes d circuit board and an easy-to-under- struction booklet. Transistors: OC169 2N408. A special vernier condenser ded for ease of tuning. All parts used grade. This kit makes an ideal gift pecial discount price of 89/6, or $8.95 Aust., P.O. Box 176, Dee Why, N.S W

ipment, Condensers, Resistors at reduced Send S.A.E. for details. Kit-Sets Aust. x 176, Dee Why, N.S.W.

CING the original English "Tone- Recording Tapes. Tensilised in sealed in PVC 3in 225ft, 60c; 5in 600ft 900ft $1.95; 7in 1200ft, $2.35, 1800ft in Polyster 3in 300ft, $1.10, 5in $2.85. Post 10c per reel. Technical ions leaflet available. Special discount ntities. Peak Electrics, P.O. Box 123 Nest, N.S.W. Phone 85-1944.

CORDER BARGAINS. New and used . Buy from a technician, not a sales- Free technical advice. All repairs and es. Country inquiries welcomed. Radio, 528 Liverpool Road, South d. N.S.W. 642-4215, Sydney.

IRE TUBES:
warranty $10; 2-year warranty $12. tube. These are Trade Prices. pes except bonded and 27in. All duds under vacuum and scratch free. When by mail, add freight. Sure Brite Picture 22a Victoria Street, Lewisham, Sydney. Phone 56-6363.

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